Ecological Consciousness as Place: Exploring Ecovillage Design in the Valley of Mānoa

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Submitted towards the fulfillment of the requirements for the Doctor of Architecture Degree

School of Architecture
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We Certify that we have read the Doctorate Project and that, in our opinion, it is satisfactory in scope and quality in fulfillment as a Doctorate Project for the degree of Doctor of Architecture in the School of Architecture, University of Hawai`i at Mānoa.

Doctorate Project Committee

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Marion Lyman-Mersereau

to all my sisters and brothers

Ua mau ke ea o ka `aina i ka pono

The life of the land is perpetuated in righteousness

-King Kamehameha III, July 31, 1843

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Preface

I was dreaming one night of an awe inspiring grove of trees. It was the kind of forest with soft light and soft underfoot. I could feel my chest grow warm from the love I felt for these trees, for this place. As I approached, for I was not there yet, I looked in horror at the chain linked fence that surrounded the place. I was no longer allowed there, it was now sacred, and the sacred cannot be touched or reached.

The way I felt in this dream was very similar to the way I felt when I started to understand current trends in urban development. Many of our major metropolitan areas and small towns alike are enforcing land-use regulations along with urban growth boundaries. The choice to stop the sprawl of human habitation has many important reasons including, but not limited to, preservation of watersheds and ecosystems. The more I contemplated the implications of crowding all the humans into dense urban environments, the more I realized that this would not work! Would this be the final disconnect between humans and nature, the final loss of our ecological consciousness?

Are we really doomed to live in an urban fabric that enables, if not downright encourages, our nihilistic tendencies? How can humankind live within the ecosystem without destroying it? Where does the human habitat fit into the ecosystem? Until modern humans regain the knowledge that all things are interconnected, taking a biocentric rather that anthropocentric point of view, then that which is sacred will remain beyond out reach.

Being thoroughly disenchanted with our current urban centers, suburbs, and general lifestyle based on constant propaganda and consumption I have sought to research in-depth a movement towards a new and old form of human habitation, the village, and to be more precise, the Ecovillage.

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I would like to thank my Doctorate Committee members, Spencer Leineweber, Marion Lyman-Mersereau, and Johanna Brickman for patiently seeing me through the process of research and design. I would like to thank my love, Trey, for making sure I always had my protein and carbohydrates to keep my brain functioning, and my brother Joseph, for the constant reality checks and comic relief. Finally, I would like to thank my mom and dad, Susan and Joe, for their constant guidance and support throughout my life and my academic career. There is no doubt that they are the key to my success.

Abstract

The goal of researching the Ecovillage as a model for human development is to better define sustainability on both the physical and metaphysical planes in order to understand what interdisciplinary approaches to sustainable design would bring us closer to healing the environment.

It is important that our current efforts to protect the natural environment are not stolen, like much of our culture, by commercial entities and trivialized beyond recognition. Already this can be seen in "Green" consumerism which enables people to continue their current patterns of consumption as long as they purchase the "appropriate" products.

The same is being seen in the design and construction industry. New industrial standards are encouraging "Green" building techniques that feature everything from water catchment to composting toilets. But is changing our design and construction techniques enough to save us from the further degradation of the Environment? Many believe that answer is no. It is becoming clearer to those of us working to protect the environment, that our culture, social institutions, and personal philosophies play a far greater role in this movement towards sustainability than previously given credit. It is true that in order to heal the Environment we must heal our built environment, but to truly heal our built environment we must heal its source, the human soul. E.F. Schumacher warned us decades ago that this revolution of sustainability must be a metaphysical one, not one based on the current dominant paradigm of consumerism and unlimited growth. This is a call for an ecological consciousness to sweep the globe.

What is this ecological consciousness and how does it apply to our personal belief systems, our cultures and our built environment? What would it mean to apply the concept of ecological consciousness, or deep ecology, to a design problem? Is it possible to create a place that allows for the learning and teaching of this ecological consciousness?

Part 1 takes a historical look at worldviews and how they continue to shape our built environment and our personal philosophies in regard to the natural environment. Modernism has proven to be enemy number one to the natural world, therefore moving

away from this worldview towards an ecological worldview could offer many benefits to the sustainability movement.

Part 2 explores in-depth what ecological consciousness means at the spiritual level, the social level and the physical/ecological level. This section summarizes the various concepts that apply to ecological consciousness and examines how these concepts are currently and historically played out in our daily lives, particularly in the daily life of an ecovillage. Ecovillage case studies are presented throughout this section to better demonstrate ecological consciousness in action.

Part 3 takes the concepts gathered in the previous sections and applies them to a physical design project in the back of Mānoa Valley on the island of Oahu, Hawai`i. The design concept is to *create a place that allows for the learning and teaching of an ecological consciousness*. The physical design is based on passive design strategies, local/recycled materials, and renewable energy opportunities while the educational program and the layout offer multiple opportunities to develop a culture of sustainability at the personal and social levels.

The theories of ecological design, cultural ecology, education, and self-realization were applied to the design of Ecovillage Mānoa, resulting in a place to learn and teach an ecological consciousness. Due to its location in the much loved and world renowned ahupua`a of Waikīkī, Ecovillage Mānoa has the potential to demonstrate and spread ecological consciousness throughout the globe.

PART 1 INTRODUCTION

Chapter 1: The Modern Worldview

There have been common threads that run throughout history to interpret the world in which humans dwell. "Every society ever known rests on some set of largely tacit basic assumptions about who we are, what kind of universe we live in, and what is ultimately important to us."[1] These common threads are referred to as worldviews and reach from a personal level to the global level.

The current worldview, from which we are currently moving away, is that of Modernism. This worldview affects every aspect of our being as well as almost every culture on the planet. It affects our spiritual beliefs, our social systems, and our physical environment. Various problems are associated with this western view of the world, environmental degradation and social inequity being the most prominent. The roots of Modern thinking can be found in the Scientific Revolution, the Protestant Reformation, and the advent of capitalism and market economies.

In the Middle Ages, before the Scientific Revolution, worldviews were dominated by religious doctrine and spiritual belief systems. Before the Catholic faith spread throughout Europe, there were polytheistic religions which believed that both the animate and inanimate aspects of nature have a spirit. Mother Nature had a soul and was regarded as such.

It was the belief of the Catholic Church that in order to gain the mercy of God, one had to go through a priest. Although many of the ancient religions also had their priestly class, shamans, or witch doctors, the common people still had direct contact with the spirits that were found everywhere in the natural world.

The Great Inquisition of 589 AD led to the loss of many of these ancient religions which regarded nature as sacred. "Every tree, rock or spring was now suspect as the abode of the devil. With torture and death hanging over the heads of all who sought aesthetic or spiritual refreshment in nature, small wonder that ordinary people came to fear and avoid wild places."[2]

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[1] Willis Harman, PhD, *Global Mind Change: The Promise of the Last Years of the 20th Century* (Indianapolis, Indiana: Knowledge Systems, Inc., 1988), 10.

[2] Frederic L. Bender, *The Culture of Extinction: Toward a Philosophy of Deep Ecology* (Amherst, NY: Humanity Books, 2003), 206.

There was another rise in the 1500s among the Catholics and Protestants to finally rid the world of polytheistic religions. Unfortunately, thousands of people were killed, "mostly women, for supposed witchcraft, which in the vast majority of cases was nothing worse than attachment to some natural landform, or for trying to preserve folk ways."[3]

This "desacralizing" of nature continued with the writings of Enlightenment thinkers, in particular Francis Bacon. Bacon goes beyond the previous interpretations of Christian texts that gave man dominion over nature. He goes so far as to say that the idea that the entire Earth and all her creatures were "endowed with the 'spirit of God' was incorrect and heathenistic."[4] These ideas of the Enlightenment thinkers became infused with those of The Church.

When Copernicus published *Revolution of the Celestial Spheres* in 1543, revealing that Earth was actually not the center of the universe, people began to question other beliefs as well. Losing faith in what priests had been teaching led to what became known as the Scientific Revolution. People were now looking for new ways to make their reality concrete once again. They wanted evidence as to what made the world go round, and that evidence needed to be observable and measureable. Understanding the world through the scientific method led to the accumulation of vast amounts of know-how. This know-how eventually led to the invention of various machines and processes that brought us into the age of the Industrial Revolution around the mid 18th century. The laws of God and Nature were slowly being replaced by those of the engineer and his great machines.

The rise of the Scientific Revolution with its questioning of the church and its doctrines, ultimately led to the Protestant Reformation, which has also been tied with the growth of capitalism. Jean Calvin, founder of the Calvinist sect of Protestantism, "argued that worldly success is the most obvious sign of God's grace and the best gauge of predestination, giving religious significance to the accumulation of wealth."[5]

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[3] Bender, *The Culture of Extinction*, 206.
[4] David Kinsley, *Ecology and Religion: Ecological Spirituality in Cross-Cultural Perspectives* (New Jersey: Simon and Schuster, 1995), 127.

[5] Bender, *The Culture of Extinction,* 215.

It was this attitude, combined with that of Enlightenment thinkers who saw nature as soulless, which led to the outright abuse and overconsumption of natural resources in return for capital gains. With nature no longer regarded as sacred there was no protection for the environment from the onslaught of the "spirit of capitalism." These constructs created by the Modernist worldview have formed our societies, our personal beliefs, and our physical environment.

Chapter 2: Towards an Ecological Worldview

Modernism has served its purpose and now must be replaced with a new worldview that can better deal with our current global conditions. Modernism gave birth to some amazing and wonderful new knowledge and technologies, but also left us in the wake of environmental collapse and vast inequities among various tribes of people across the globe. What we need now is the rise of an ecological worldview, an ecological consciousness.

"The current story of Earth is divided between science and religion. Both flawed in that neither recognizes the oneness of all things, and they both deny the mystery."[6] The science of ecology has helped to bridge this gap between science and religion. "In scientific ecology, the ecological whole is sometimes viewed as an interrelated system of beings that are all temporary forms of synthesized and individual manifestations of solar energy. In this sense, an individual is basically a temporary, encapsulated form of energy that is in constant flux."[7] This scientific realization has long been the basis for many spiritual and philosophical beliefs that have influenced the Deep Ecology movement, such as Brahman in Hinduism from which "all arises and all is contained" as well as the recognition of chi in Eastern philosophies.[8] This realization is the basis of an ecological consciousness.

The call for a Deep Ecology is the recognition of the need for ecological thought to reach our psychological and spiritual selves. Deep Ecology results from the constant questioning of deep spiritual and philosophical beliefs and an attitude which understands the necessity for the preservation of the environment. It was Arne Naess who helped coin the phrase in an article written in 1973 entitled "The Shallow and the Deep, Long-Range Ecology Movements." Deep Ecology recognizes that human beings are an integral part of an organic whole not only in the material world, but also in the spiritual realm of

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[6] Thomas Berry, *The Dream of the Earth* (San Francisco: Sierra Club Books, 1990), 132.
[7] David Kinsley, *Ecology and Religion: Ecological Spirituality in Cross-Cultural Perspective* (New Jersey: Simon and Schuster, 1995), 190.

[8] Kinsley, *Ecology and Religion,* 190.

existence.[9] This thinking has its roots in various spiritual beliefs and philosophies such as those of indigenous or "primal" peoples, naturalism and pastoralism, Christianity, feminism, philosophy of Heidegger, eastern spiritual practice, and the naturalist writings of Robinson Jeffers and John Muir.[10]

By recognizing that humans are intimately connected to each other and their environment, there is once again the potential to recognize that all of nature is endowed with the spirit and therefore has intrinsic value that deserves our respect and protection. Arne Naess often found solace in the philosophy of Baruch Spinoza, who once said:

> "The supremely free human being, is one of introvert tranquility. The Sage, like Mahayana Buddhism, holds to the idea that the higher level of freedom reached by an individual, the more difficult it gets to increase the level without increasing that of all other beings, human and nonhuman."[11]

Not only is there a need for an ecological consciousness at a philosophical and spiritual level, there is also a need to redefine our cultures and our social institutions. Ecological consciousness recognizes appropriate cultures as those that rise out of place. Our relationship with our physical environment must start to reflect this new awareness.

Bringing about a greater awareness of place through our culture will make it easier to implement the ecological design strategies that are often disregarded because of social and cultural beliefs and barriers. Ecological design strategies must be incorporated by everyone in all design processes. After all, we are all designers of our world and play a huge role in the creation and protection of our environment.

If humans are to achieve their vision of a sustainable life, one that is in harmony with nature, then we must work towards an ecological worldview. The changes in the current worldview must take place simultaneously in our built environment, our philosophies, and our cultures. The reality is that they are one and the same and one cannot improve without the help of the other. They are interdependent. Changes in

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[9] Bill Devall and George Sessions, *Deep Ecology: Living as if Nature Mattered* (Layton, UT: Gibbs M. Smith, Inc., 1985), 66.
[10] Devall and Sessions, *Deep Ecology*, 80.
[11] Devall and Sessions. *Deep Ecology, 238.*

personal philosophies allow for changes in society and culture which allow for changes in our built environment. Changes in our built environment can bring about spiritual changes that can help affect the social changes, and so on.

PART 2 ECOLOGICAL CONSCIOUSNESS EXPLORED

Chapter 3: The Ecological Consciousness Movement

Ecological consciousness is a thought, it is a culture and it is a place. It is a place that acknowledges history, tradition, and genius loci. It is a place where we are reminded and made aware of that which sustains us. It is conservation, restoration, and preservation of that which feeds us. It is a place of lifelong and holistic learning, a place to share, store, and research local knowledge. It is a catalyst for change in our local cultures and systems of knowledge transfer. Ecological consciousness is a worldview that connects us all on a global scale, and it is a personal philosophy that connects us with the here and now.

Ecological consciousness is something that humans have kept with them throughout history. Sometimes it reveals itself and other times it is hidden. Our current movement away from the Modern worldview is revealing it once again. How should this new worldview of ecological consciousness manifest itself? If we are truly an integral part of our environment then this shift in consciousness must take place within our own mind. This kind of self-reflection can often be difficult when we are, at the same time, part of a culture that is larger than ourselves. Denying our culture can often be as painful as exile. So to truly find self-realization our cultures must change along with us. Our educational systems, perhaps the greatest force in creating culture, must once again allow for the exploration of our deepest convictions as well as the exploration of the place where we are now, the place we inhabit, where we dwell, our bioregions.

There are various groups of people across the globe who are developing new ways of living on Earth. There are movements such as "Livable Communities" and "New Urbanism". There is "Green" building and Ecological Design. "Community" planning is helping to reengage people with their local environments, while there are other tight knit groups who are coming together to develop their neighborhoods or villages on their own. Religious groups are rethinking their relationship to nature and are stepping up to take part to step more lightly. On a personal level people are also rethinking their relationship with nature through philosophy and spirituality. Learning institutions are changing their definitions of what knowledge is and how to teach it. Bio-regional centers are being constructed to help store, share and research cultural and

ecological knowledge of their particular region, allowing for them to better care for their immediate environment.

There are various institutions that are now teaching towards an ecological consciousness. Lesley College, primarily a teachers college, in Massachusetts, currently offers an M.S. degree in Ecological Leadership and Education. The courses offered have a focus based on the physical, spiritual and cultural aspects of society as they relate to an ecological consciousness. The following is a list of some other examples of organization taking on this new perspective in education.

- Arizona State University offers programs in Sustainability.
- Institute for Earth Education, Cedar Cove, Greenville, WV.
- Evergreen College
- Remote Studio at Montana State University
- Lanainaluna High School
- Waters of Life public school charter in Hawai`i

The Frank Lloyd Wright School of Architecture began as a Learning in Residence experience and still carries on that tradition. Students are living in a community that exists as the school itself. There are gardens supplying food for shared meals. Student take active participation in taking care of the property and cooking meals. The first year students are also required to build their own structure in which to live in the desert of New Mexico. This is a deep experience that allows the individual to delve into their natural world, giving them a better understanding of designing with nature.

These groups are coming together to create ecologically conscious communities and villages, many of which have agreed upon the name of Ecovillage, while others go under a different guise, such as The Center for Regenerative Studies or The Community for Bioregional Studies in Sustainability. Regardless of the name the principle is the same, to allow for the learning and growth of an ecological consciousness at the personal, social, and ecological levels.

Ecovillage Defined

Ecovillages have their roots in many social movements as well as design theories. There have always been groups of people working towards the creation of peaceful, equitable, healthy environments. It is movements such as communes, co-housing, New Urbanism, Smart Growth, and "green" building that ecovillages have sprung from.

It is not hard to understand, with the harsh living conditions and social inequity of the mid 19th century, why communities of people, known as the Utopian Societies, were compelled to break off into smaller groups in order to create a more equitable society. Many of these communities were social experiments in community living, and some have lasted until our present day, such as the Shaker communities, who looked to their religion to support their new utopian ideals.

The purpose of these communities is reflected in a letter written in 1840 to Ralph Waldo Emerson from George Ripley inviting him to join the intentional community of Brook Farm.

> "Our objects, as you know, are to insure a more natural union between the intellectual and manual labor than now exists; to combine the thinker and the worker, as far as possible, in the same individual; to guarantee the highest mental freedom by providing all with labor adapted to their tastes and talents, and securing to them the fruits of their industry; to do away with the necessity of menial services by opening the benefits of education and the profits of labor to all; and thus to prepare a society of liberal, intelligent, and cultivated persons whose relations with each other would permit a more simple and wholesome life than can be led amidst the pressure of our competitive institutions."[12]

And it would follow that in 1845 Henry David Thoreau, Emerson's student, would find himself living alone beside Walden pond, where he too was experimenting with his own social ideals, and was a "designer of a kind of minimum utopia, a do-it-yourself utopist."[13]

While utopians were working out the social issues of the time, designers and planners were working on creating the physical environment that would house these new social ideals. The City Beautiful movement of the early 20th century worked to change

[12] Richter, *Utopias,* 54.
[13] Richter, *Utopias*, 59.

the built environment in a way that included natural parks and open spaces along with public buildings. A similar movement, The Garden City Movement, was "less formalized and oriented toward 'green' natural areas, parks, and walks that safely isolated neighborhood activity from the street", which was an ever more present need with the advent of the automobile in 1908. These designers sought to "maintain a village atmosphere, accommodate the automobile, and incorporate farmland and natural areas into their designs."[14] Like the utopians of the late 19th century, the goals of these city planners were aimed at creating healthy happy citizens. The former through social design, and the latter through a manipulation of the physical environment.

Many youth during the 1960's-70's set out to create their own societies based on peace, love, and equity outside the influence of the current social situations. These communes typically had some autonomy from the surrounding communities, but within the commune the members were expected to interact and work together. They shared a set of common beliefs that were explored in frequent discussions and formal meetings. There was often a lack of personal space and privacy that caused communes to breakdown and change their structure.[15] Most resources were shared and there was little or no personal property. They were unique in that they are often characterized as having a charismatic leader. The members often shared some common goal or system of beliefs, ranging from environmental to religious.

One of those communities that does still exist, The Farm, in Tennessee, is no longer technically a commune, but has had great staying power, mostly due to their ability to allow for growth and change in their philosophies about what a community should be. They started out a full fledged commune, where all material possessions and money were pooled together for the use of the whole. After peaking out at 1500 members, the population at The Farm began to drop as people became fed up with "poverty and lack of control in their lives."[16] The individuals then abandoned the idea of pooled resources and each family had to take care of their own financial needs as well as

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[14] William Fulton. *New Urbanism, Hope or Hype for American Communities* (Lincoln Institute of Land Policy, 1996), 8.
[15] Rupert Fike, *Voices from the Farm, Adventures in Community Living* (Summertown, TN: Book Publishing Company, 1998), xi.
[16] Fike, *Voices from the Farm*, 141.

pay a fixed rent each month. Community businesses became privatized and co-workers became employees. Currently The Farm is part of the Global Ecovillage Network and is working hard to create an ecological consciousness within their community and in the world.

A later development in the realm of community design is that of co-housing. Co-housing is an intentional community comprised of a group of private homes, but also with considerable shared, or community spaces. Besides their kitchen at home, residents often share a community kitchen and dining area, where members of the community take turns cooking meals for each other. Some other common facilities may include childcare, internet/office space, recreation facilities, offices, gardening equipment and space, and a tool shed. Money, time and space are saved because of the sharing aspect of co-housing, such as shared childcare and meal preparation. The owners are the developers of the site, allowing the design to more likely meet the goal of fostering social relationships than a typical developer's plan. [17] People were taking back their communities from the hands of capitalist developers.

The New Urbanism design theory, developed in the 1990's, is also working to create a new type of community by taking ideas from both social reformers and city planners. Not only does New Urbanism support social ideals such as affordable housing, social and economic diversity, and strong citizen participation it also supports the idea that the community's physical infrastructure can create or influence particular social patterns.[18] The New Urbanism promises many things, such as, the ability to create happier citizens, and a sustainable future through regulating the built environment, by having small streets, and front porches, mixed use, and high density. Although these are interesting design solutions, there is a fear of the Disneyland syndrome, and rightfully so. One look at the suggestions put forth in the *Neighborhood Pattern and Design Section on Walkable Streets,* and design intentions become clear and concise. The New Urbanism claims they try to avoid the Disneyland syndrome by encouraging design with the region in mind, by trying to "build upon each region's natural and cultural structure to reveal its

[17] Chris ScottHanson, and Kelly ScottHanson, *The Cohousing Handbook:Building a Place for Community, Revised Addition* (Canada: New Society Publishers, 2005), 98.
[18] Fulton, *New Urbanism*, 1.

inherent potential through an intensive regional analysis, rather than impose standard planning solutions." [19]

The Club of Rome with their 1972 report "Limits to Growth" made it very clear that the earth is no longer going to be able to support the continued growth of human population and consumption across the globe. Smart Growth advocates have begun to offer some useful solutions to the problems of this growth known as urban sprawl. The Smart Growth movement has grown out of the recognition that urban sprawl is costing us resources, air and water quality, time, money, community, and the general health of our environment. They support infill projects and mixed use zoning. They also support the use of mass transit. These solutions may protect farmland and give new life to blighted cities, but there are also limits to urban density related to congestion, health, safety, and quality of life.

Ecovillage summits were being held in 1990's in an effort to help define this new movement in community design. Ecovillages were given the definition of "human-scale, full-featured settlements in which human activities are harmlessly integrated into the natural world in a way that is supportive of healthy human development, and which can be successfully continued into the indefinite future."[20]

This definition reflects the holistic approach that ecovillages are taking towards human development. It is not just physical development as may be defined by a real estate agent, but development of the metaphysical realm as well. The use of the terms *human scale* and *full-featured* reflect some old and new theories in urban planning and development. Human activities being harmlessly integrated into the natural world reflects the theories of Ecological Design and Permaculture as well as the "Green" Building movement. This statement also reflects the underlying spiritual and philosophical theories that find a common ground in a reverence and respect for nature. These spiritual and philosophical beliefs are often the "glue" that holds together the community, or the "foundation" on which it is built.

This integration of the ecovillage with the natural world must be done in a way

[19] Fulton, *New Urbanism,* 22.
[20] Jan Martin Bang, *Ecovillages: A Practical Guide to Sustainable Communities* (UK: Floris Books, 2005), 27.

that is supportive of healthy human development. This reflects the spiritual beliefs and philosophies found in the ecovillage as well as the social/cultural systems that have established themselves within the villages. This healthy human development refers to quest for self-realization, but also the belief in community and the strength, or social capital, that comes from a healthy community. This health can be found literally in holistic and preventative medicine, but also in governing practices, education, economics, and the recognition of the development of a cultural ecology, where human culture is again allowed to rise out of place.

Ecovillages striving to *be successfully continued into the indefinite future*, are striving to be sustainable. It means applying theories of sustainable design and land use, such as Permaculture and Ecological Design. It also means allowing for a social system that allows for cultural traditions to be carried on from one generation to the next through example, ritual, and education. It means increasing self-realization of each individual so that they better understand the important role they play in the health of their ecosystem and the health of the entire human race.

Education is perhaps the greatest tool ecovillages use to promote sustainability in their communities and in the world. Ecovillages offer an appropriate learning tool for our age in that they reflect the need for a paradigm shift to an ecological consciousness. In *Ecocities: Building Cities in Balance with Nature,* the author Richard Register recognizes that ecovillages are helping to build a "culture of acceptance"[21], by teaching through example. The more sustainable practices become socially acceptable, the more room there will be for growth of an ecological mind. Some ecovillage groups find it easier and necessary to stay off the radar of the internet and out of the mainstream societies. However there are other ecovillages that are both living and teaching an ecological consciousness.

Education within the ecovillage takes place on many levels, and is the key to the spreading of an ecological consciousness. Ecovillages offer a lifetime of educational opportunities for the members of the community, both young and old, by creating an

[21] Richard Register, *Ecocities: Building Cities in Balance with Nature* (Berkeley: Berkeley Hills Books, 2002), 281.

environment that encourages self realization, deep relationships with people and nature, and sustainable living practices.

Many Ecovillages have created relationships with other educational institutions such as colleges and universities to help spread ecological consciousness. Relationships with institutes of higher learning offer great mutual benefits for all parties involved. Ecovillages also find it important for their existence to help educate government officials about ecological consciousness. Issues arising from building codes and zoning regulations often arise due to the experimental nature of ecovillages. This is a great opportunity to educate the officials who will then be more willing to approve of ecological design in the planning and permitting process. And finally there is the need to reach out to the surrounding bioregion and world at large to learn new ideas and to teach the lessons learned by living the ecovillage lifestyle. Ecovillages all over the world open up their homes and lands to offer workshops and live/learn experiences for people outside of their community. Ecovillages are also helping to spread ecological consciousness by participating in educational opportunities across the globe such as visiting other villages or attending conferences of global significance

Ecovillages often consider themselves leaders in the sustainability movement and feel that it is their responsibility to teach what they have learned to others both within and outside their community. Alternative, holistic education continues to be the core activity and largest single source of income for many intentional communities.[22]

[22] Jonathan Dawson, *Ecovillages, New Frontiers for Sustainability* (White River Junction, VT: Chelsea Green Publishing Company, 2006), 17.

Chapter 4: Ecological Consciousness as Philosophy and Spirituality

Human consciousness has been described as having two main aspects. One being primary consciousness which includes "basic cognitive, perceptual, sensory, and emotional processes we share with other mammals and vertebrates,"[23] the other being the reflective consciousness, which is considered "a level of cognitive abstraction that includes the ability to hold mental images which allows us to formulate values, beliefs, goals, and strategies."[24]

A sustainable future is going to require drastic changes at the level of the reflective consciousness in vast amounts of individuals. There is a need to search deeply into ourselves to find out what it is that really makes life worth living. Ultimately, through the process of meditative thought and personal reflection, most will find that the constant consumption of material goods is not making them or their families any happier.

In her book *Safeguarding Our Common Future*, Ingrid Stefanovic gives a phenomenological interpretation of sustainability. In Heidegger's phenomenology, Plato and Descartes are blamed for the current worldview based on ego centeredness and material beauty. Heidegger states that because Plato related beauty to forms that the form was being valued more than the being itself. Therefore being was made to seem "vague, mystical, vaporous, and ultimately meaningless."[25] And, according to Heidegger, Descartes famous philosophy of "I think, therefore I am" has lead to the modern paradigm of ego-centeredness,[26] which ultimately puts human needs and desires above all else. The current dualism of human and environment is very much in contrast with Heidegger's belief that one cannot "be" in the absence of space; never are we truly individual. We are in-the-world thus our "environment" is us and surrounds us. "As the

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[23] Edward V. O'Sullivan and Marilyn M. Taylor, ed., *Learning Towards and Ecological Consciousness: Selected Transformative Practices* (New York: Palgrave Macmillan, 2004), 6.

[24] O'Sullivan and Taylor, ed., *Learning Towards an Ecological Consciousness*, 6.

[25] Ingrid Leman Stefanovic, *Safeguarding Our Common Future: Rethinking Sustainable Development* (Albany, NY: State University of New York Press, 2000), 23.

[26] Stefanovic, *Safeguarding Our Common Future*, 26.

environment and self are not separate, as we are in-the-world, the environment is the incarnation of my very existence."[27]

There is the need to move past the position of ego-centeredness which has to be done through the process of self-realization. Self-realization is a movement toward "authenticity" or an "essential openness to the world."[28] Heidegger describes two types of thinking, calculative and meditative. [29] "[Meditative thought] returns us to an originative contemplation of the grace of existence and the recognition that all things in the universe are not present merely for the sake of their utility and for our control."[30] Through meditative thought self-realization manifests itself in compassion for all beings. It is through this compassion, or "root-connectedness"[31], that we are able to make our decisions out of love and not fear. It is through this compassion that we will be able to find the strength to make the changes that are called for in our social and physical worlds in order to achieve a sustainable existence.

Changes in personal philosophies and spiritual beliefs are key to changing the lifestyle habits that have reaped so much havoc on our natural environment. Understanding that every decision we make affects every other being on this planet is cause to make more responsible decisions toward a sustainable future.

Ecovillage Philosophy and Spirituality

The overriding spiritual and philosophical theme held in common between the various ecovillages is the respect for the fact that everything is interconnected, not just at the physical level, but the metaphysical as well. Within the ecovillage, this deep ecological thinking is typically accompanied by a respect for diversity of belief systems, without ties to any particular religious dogma. Typically, the people who have come to live in an ecovillage community have often developed personal philosophies and spiritual beliefs based around voluntary simplicity, which is an important step towards conserving

[27] Ibid., 44.
[28] Ibid.
[29] Ibid., 23.
[30] Ibid., 24.
[31] Ladelle McWhorter, ed., *Heidegger and the Earth: Essays in Environmental Philosophy* (Missouri: The Thomas Jefferson University Press, 1992), 65.

our precious resources. Many ecovillagers also recognize that they are not the only spiritual beings in their community; the land, and creatures upon it, are regarded as having spirits of their own.

Many people who choose to live and learn in these types of communities have already recognized the values of voluntary simplicity, which led them there in the first place. Voluntary simplicity is a movement that is based on finding a balance between needs and desire. It is a recognition that the best things in life often are those that are free, and that true wealth reaches far beyond the confines of the dollar. Voluntary simplicity offers some relief for our natural environment, the finite source of our seemingly endless consumption. It often means consuming less energy through a change in lifestyle. Voluntary simplicity also offers personal relief from the constant need to earn money in order to fulfill desires that could be fulfilled though more deeply satisfying means.

Ecovillages are allowing for transformative learning by providing an open minded atmosphere that encourages learning and reflection. Transformative learning is a movement in educational theory that is helping people to reconstruct their worldviews in order to help create a more sustainable, kinder, and gentler existence. Learning Ecology is achieved using the framework of Transformative Learning.

Not only do ecovillages encourage deep reflection on one's spiritual path, they also recognize that the place in which they dwell also has spirit flowing through it. This spirit is recognized as being intrinsic to the nature of the site but is also a spirit endowed by the humans through patterns of usage.[32] Connecting with the spirit of the site is often done through group and personal meditation practices as well as using methods such as geomancy, or Fung Shui. This is to help understand what the site wants to be.[33]

Living a life of voluntary simplicity has many benefits for those who participate. The benefits go far beyond the ecological aspects of saving energy and resources. The lack of focus on material possessions leaves people more time and resources for more fulfilling lifestyles. As for the land, she and her creatures are treated as part of the community and their needs are considered just like any other soul. Not only are

[32] Bang, *Ecovillages: A Practical Guide to Sustainable Communities*, 97.
[33] Ibid.

ecovillagers being gentler to the land, they are also being kinder to each other by creating an atmosphere that encourages diversity of thought and transformative learning.

Case Study 1: Findhorn Foundation, Scotland

The Findhorn Foundation was founded on spiritual principles and much of their educational efforts are in the spiritual arena. Their spiritual beliefs are based on local culture which came out of the Christian Mystery Religions and promote ideals of personal realization and mutual respect for all animate and inanimate beings. With the recent creation of the Ecovillage at Findhorn, ecological learning experiences with the built environment are now making their way into the curriculum at Findhorn, where ecology was previously focused more on the natural environment than the built environment. Findhorn Foundation is working towards being an example of sustainable living and look to the surrounding traditional communities for much valued information about living off the land.

Spirituality

Since their humble beginnings on the sandy shores of the island of Scotland, the Findhorn Foundation has made great steps towards fostering an ecological consciousness within their own community as well as in the world. Established in the 1960's, not as an ecovillage or an educational center, but as a home for two families who had decided to finally park their caravans and put down some roots, literally. They began farming their small plots of land with great success, apparently with miraculous success considering the soil types. Credit for this success is given to the advice of spirits at the site that were contacted through meditation and quite listening, "listening to that ever so quiet voice within." Their success with growing vegetables attracted more and more families to come and join them in their spiritual approach to cultivating the earth.

Findhorn has created a unique educational experience aimed at educating people about what it means to live a life based on "practical spirituality and conscious, sustainable living."[34] This experience is a seven day visit to Findhorn called "Experience

[34] http://www.findhorn.org/workshops/essential/essential.php (accessed Nov 2008)

Week". This tradition at Findhorn has been in practice since 1974 and they have had over 30,000 participants over the years.[35] This program introduces participants to the spiritual principles of the village which include "attunement to the sacred, inner listening, respect for the interconnection of all life, service to the planet and personal sharing."[36] The visitors are also all included in daily activities of the village such as gardening and cooking. During this week there is a strong focus on supportive group work, meditation, nature outings and sacred dance (see fig. 1).

Figure 1. Findhorn Foundation Group Meditation
Source: http://www.kheper.net/topics/Findhorn/index.html (accessed April 22, 2009)

The "Life Purpose" workshop is another week long program offered at Findhorn. This week is focused on personal and spiritual growth. An example of the types of courses offered is "Healing through Art". One of the main goals of this training is to **"**develop and refine artistic skills which cultivate and express" the qualities of health, purpose, self-esteem and fulfillment in life.[37]

[35] Ibid.
[36] Ibid.
[37] http://www.findhorncollege.com/proftraining/hta_found.php (accessed Nov 2008)

Other opportunities for learning and spiritual growth are offered through workshops. The list of workshops offered through the Findhorn Foundation is extensive. Some of the available workshops are in art, song, movement and dance, Ecovillage Education, Gardens and Nature, Health and Healing, and the Spiritual Practice workshop which examines "our individual ways of opening."[38]

The site and surrounding natural environment of Findhorn play an important role in the spiritual reflection that is encouraged of anyone participating in the community. There is the quiet and beautiful Moray Coastline and Findhorn Bay nearby, while the local golf course is used to teach the spiritual/meditative principles of golf. (See fig. 2.) The Findhorn ecovillage also features a beautiful meditation retreat onsite where people may commune with the spirits of nature alone, or in a group. (See fig. 3.)

Figure 2. Morray Bay at FindhornFoundation
Source: http://picasaweb.google.com/JHutton108/MyTop40CollegeWebsitePhotos#5165734693219469474 (accessed April 22, 2009)

[38] Ibid.

Figure 3. Findhorn Meditation Retreat
Source: http://picasaweb.google.com/JHutton108/FindhornFoundationForWebsite#51657274132 (accessed April 22, 2009)

Culture

The ecovillage at Findhorn is striving to create a culture of ecology in various ways. Community lifestyles become part of every visitors stay at Findhorn Foundation as they are asked to participate in the caring of the gardens, kitchen, or buildings during any length of stay. They have sessions and workshops in group work and conflict resolution in order to handle the complex social dynamics that arise with community development. Findhorn also recognizes and reaches out to the local community for cultural clues to better inform them about living sustainably on the land. Other small community farms, not affiliated with Findhorn Foundation, are observed for their production methods, such as the Island of Erraid, an almost entirely self-sufficient community located off the shores of Findhorn Ecovillage. They are also members of the UK's oldest and largest Community-Supported Agriculture (CSA) system.

Other aspects of the community design offer various opportunities for learning, sharing and quiet reflection. There is a Visitor's Center as well as The Community Centre with kitchens, dining space and a meeting room. The Universal Hall, a major regional theatre complex helps to encourage participation in community activities, celebrations, the arts, dance, and music. There are also the Moray Arts Center and craft studios, four meditation sanctuaries, a small library, and a community organic shop. Local natural areas also provide both educational and recreational opportunities, such as the nearby beaches, rivers and forests. Findhorn Bay and the Moray coastline are both nearby.

Findhorn Foundation has increased their global educational opportunities by becoming a certified training center for CIFAL. CIFAL stands for the "International Training Centre for Local Authorities/Actors" (*Centre International de Formation des Autorités/Acteurs Locaux*). It was set up by the United Nations Institute for Training and Research through their department focused on empowering local authorities to achieve the UN's Millennium Development goals of sustainable urbanization.

Findhorn College was established in 2001. They offer a variety of accredited courses based on a "holistic approach to learning that combines the best of mainstream education with experiential learning, personal and spiritual development, and learning valuable life and work skills."[39] They are also working closely with other colleges in Scotland to offer more opportunity to teach and learn sustainable lifestyles.

Besides being connected with their own college, the ecovillage at Findhorn allows their site to be used as a teaching resource for other universities, schools and organizations. They are also involved in creating curriculum for other schools and universities based on the ecovillages roots in sustainable community design.

The Physical

The physical site of Findhorn Foundation has two main areas. The first area of land is called The Park and is location where the original community started. This is also where the Findhorn Ecovillage is located. The Park provides a single-storey wooden lodge or bungalow shared with a few others.

The second main area is known as Cluny Hill, which is a beautiful old 4 star hotel that has been converted to classrooms and other learning facility support areas. The site of Cluny Hill is about 5 miles from The Park. Cluny Hill, 5 miles away in Forres, has a grand old hotel, where one can stay in a shared room with shared facilities. This is the home to about 30 community members and up to 100 guests at a time, participating in Foundation programs and courses. The facilities here include laundry, pay phones, internet access, shop and sauna.

[39]The Findhorn Foundation, http://www.findhorn.org/workshops/workshopspage/college.php (accessed November 2008)

Although it is possible to fly into Forres, it is recommended to take the bus or rail systems because of its lower carbon footprint. The Findhorn Foundation offers free regular bus system connects The Park and Cluny Hill which are about 5 miles apart.

Much of the curriculum taught at Findhorn includes social and spiritual work, but not all the classes are actually held at the sight of the physical Ecovillage. What does take place in the physical Ecovillage are the courses and workshops based on the Ecovillage Training and Ecovillage Design. The Findhorn Ecovillages offers educational opportunities to over 9,000 visitors a year from all over the world.[40]

The ecovillage at Findhorn was not the original idea behind creating their community. Although Findhorn had been doing much work in their local areas by creating demonstration sites for ecological restoration and wilderness protection, they were realizing more and more that their ecological consciousness needed to be better reflected in their built environment. (See figs. 4 and 5). Thus the ecovillage development began moving people out of their energy hogging caravans and into fully insulated eco-friendly homes powered by the sun and community wind turbines. Using their knowledge, both old and new, of sustainable building practices, Ecovillage Findhorn was able to create the UK's first technical guide to ecological housing. This guide has allowed the ecovillage to spread its knowledge not only to their local municipalities but to the world.

Figure 4. (left) Findhorn ecovillage "barrel" homes
Source: :http://www.earthfuture.com/econews/back_issues/07-01.asp (accessed April 22, 2009)
Figure 5. (right) Findhorn ecovillage housing
Source: flickr.com/photos/70887256@N00/1468244572(accessed April 22, 2009)

[40] http://www.findhorn.org/whatwedo/ecovillage/ecovillagefindhorn.php (accessed Nov 2008)

The 55 ecologically-benign buildings- 7 of which are B&Bs, include numerous solar water heating systems, a comprehensive recycling scheme, Biological Living Machine sewage treatment system, along with 4 wind turbines that supply all electricity for the village. (see figs. 6 and 7).

The month long Ecovillage Training Conference happened again in February 2009 and focused on the topics of right livelihood, food and farming, human habitat and ecological restoration. This month long learning experience also includes an optional visit to the island of Erraid, an almost entirely self-sufficient community. There is also a conference held at Findhorn Ecovillage called "Ecovillage Design Education- Training of Trainers". The most recent of these 4-week conferences focused on ecovillage topics of social design, ecological design, economic design, and worldviews.

Although the ecovillage at Findhorn started out as a small farming community more interested in the natural world than the built environment, they have become a leader among ecovillages in their sustainable design strategies as well as community lifestyle and culture. The learning opportunities at this ecovillage will continue to increase and become richer as they recognize more and more the close connection between our built environments and the health of the natural world upon which we depend for our spiritual and physical sustenance.

Figure 6. (left) Findhorn "Living Machine"
Source: www.Findhorn.org (accessed April 22, 2009)

Figure 7. (right) Wind turbine at Findhorn Foundation
Source: http://www.flickr.com/photos/sashasquatch/1463665298/

Chapter 5: Ecological Consciousness through Culture and Society

> We often think that when we have completed our study of *one* we know all about *two* because two is one and one. We forget that we still have to make a study of *and*.
>
> -A. Eddington

At a personal level, consciousness is seen as our mental constructs. As these constructs are combined at the social level our consciousness begins to become "the taken-for-granted beliefs, assumptions, rules, and values that constituent members of the culture share as reality."[41] Ecological consciousness arises not only out of our personal philosophies and spiritual beliefs but also out of this social consciousness, or culture.

Merriam-Webster defines culture as "the integrated pattern of human knowledge, belief, and behavior that depends upon the capacity for learning and transmitting knowledge to succeeding generations." It is through these integrated patterns that we develop a cultural ecology based on our relationship with the natural environment. The various tribes of people around the world who have created cultures based on a connection to their natural environment are helping to protect and encourage the biodiversity that is so imperative to the continued health of the web of life. This cultural ecology is perpetuated not only through education but also through ritual and celebration.

The very first principle of ecological design, as defined by Sim van der Ryn, a renowned designer of sustainable and ecological architecture, is that, "solutions grow from place." The idea that culture grows from place is known as *cultural ecology*. This is a controversial area in that there are obviously more factors determining a society's culture besides the local natural environment, especially today with global technologies. It would be easy to describe the cultures of truly indigenous peoples to be a cultural ecology, but this culture has slowly been lost with the advent of technologies and the spread of western civilization across the world. My question then is this, is there an appropriate way to create a culture that will result in an ecological consciousness? And what has the loss of indigenous cultures meant for the health of the planet?

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[41] O'Sullivan and Taylor, ed., *Learning Towards an Ecological Consciousness*, 7

This issue is especially interesting in the United States where we have, what is often referred to as, a "melting pot". Unfortunately, this concept of melting everything together has led to a spreading homogenization of culture, or monoculture, in every corner of our country. The corporate monoculture is most apparent in the ever similar and ubiquitous retail establishments such as McDonalds and Starbucks that are found on the corners of most towns in America and in most of the world's large cities. If we are working towards nurturing an ecological consciousness throughout the world, then it would seem appropriate to avoid monocultural and to embrace cultural ecology in our activities and social institutions in order to encourage diversity.

One of the greatest lessons of sustainable community development is that of diversity. Diversity starts at the level of the individual. In order for a tribe of people to sustain themselves, there needs to be a diversity of skills. In order to satisfy the needs of a village, there needs to be a diversity of spaces. And to create a more stable society there needs to be a diversity of community types. As long as people continue to grow in consciousness our towns and cities will begin to reflect our ideals of sustainable communities, regardless of which model they choose.

A *cultural ecology*, rising out of place, would offer a new and old pattern for belief systems, social forms, and materiality. In this way people would be more responsible (able to respond) to their local environment and more empowered, informed, and committed to protect it.

It is recommended that gardeners save seeds from their vegetable garden in order to build up an heirloom seed collection which is resistant to local pests and disease. These seeds have adapted to their natural environment in a way that they will be happy and productive for the gardener. So what of humans? How many generations does it take to have life that has found harmony with a place? The issue of transience has led to the rootlessness that has become one of the greatest challenges in the development of cultural ecology and has led to a renewed interest in bioregional development and education.

Our Indigenous cultures give us clues for cultivating connection to place. They have often used ritual and celebration to mark important days, to recognize the cycles of the moon and nature, to restore, renew, and reflect upon where we are in time and space,

as well as to pass knowledge and values to the new generations. Rituals and celebrations have great potential to be powerful teachers. Stories of old that have come out of a place contain much accumulated knowledge, the type of knowledge that only generations of understanding can create. New stories also need to be created to compliment the ones of old. There is the need to recognize and allow for change. These new stories and legends have the potential to write a new story of Earth and how we treat her. By reinstating these knowledge pathways we can hope to create a new understanding of place and our role as inhabitants.

In order to achieve our goals of creating a sustainable existence on Earth, there is also a need to reevaluate our definition of knowledge, especially in our educational institutions. There is a desperate call among many educators for reform to a transformative type of learning, a learning ecology. Merriam-Webster offers another definition of culture as "the act or process of cultivating living material (as bacteria or viruses) in prepared nutrient media ; also : a product of such cultivation." This is of interest not because the human race is necessarily a bacteria or virus. Rather, the idea of a culture being a growth that comes out of a prepared nutrient media is where the opportunity lies for changing our relationship with our environment. Our institutions of higher learning are in drastic need of a new nutrient medium.

The current system which tends to separate and fragment education into various seemingly unrelated subjects fails to see the wholeness of human experience. Putting theories into action requires the recognition that in real life there are no rigid dividing lines between subject matter, and often the whole is greater than the sum of the parts.

Our education system has put great emphasis in the past 100 years to create neat packages of information that, once absorbed, can direct someone on the path of one career or another for which they are best trained. This type of pre-packaged education rarely allows for the development of critical thinking skills nor does it allow for a transformative process. E.F. Schumacher recognizes that the problems with our education systems are a "reflection of the deepest problems of our age. Education which

fails to clarify our central convictions is mere training or indulgence."[42] *Learning Towards an Ecological Consciousness,* a collection of essays by contemporary educators and environmentalists who are calling for a "Learning Ecology,"[43] calls for a" holistic framework that is both ecological and cosmological". It provides a "means for understanding and working with the complex and diverse ways in which individuals learn, become more conscious, develop worldviews, change and act on their values." Learning Ecology also calls for a consideration of "the complex personal, social, ecological and spiritual contexts within which learning and transformation occur, and also the social roles of learning that transcends the need of the individual."[44] By recognizing the complex framework in which our learning takes place, our curriculums are going to have to change to encourage a more holistic learning environment, which is going to include putting our theories into action and all members of society accepting their responsibility as teachers.

Allowing our cultures to once again arise from the natural environments in which we live is the key to a sustainable lifestyle in that it makes us more aware of the health of our local environments, it allows for the strength provided by diversity of cultures, and allows for more appropriate use of our natural resources. The greatest tool for creating and sustaining this culture of place is that of education. Education not only takes place in the classroom, it can take many forms such as story, ritual, celebration, song and dance. Not only must education help to continue the movement towards sustainability, it must also allow for a type of learning that is holistic and that allows for transformation of the individual.

Ecovillage Culture and Society

Ecovillages are putting these concepts of cultural development and transformative learning to the test. They are creating the supportive emotional settings that are often necessary for people to feel comfortable when going through personal transformation and growth. These settings often offer mutual support and effective group work to help

[42] E.F. Schumacher, *Small is Beautiful*: *Economics as if People Mattered* : *25 Years Later with Commentaries* (Vancouver, BC: Hartley & Marks Publishers, Inc., 1999), 79.
[43] O'Sullivan and Taylor, ed., *Learning Towards an Ecological Consciousness*, 50.
[44] O'Sullivan and Taylor, ed., *Learning Towards an Ecological Consciousness*, 50.

create these conditions. Ecovillages are not only creating new cultures based on sustainable lifestyles, they are also becoming centers for the preservation of traditional cultural knowledge. Often the learning experiences within the ecovillages combine new and traditional knowledge in the rituals, celebrations and educational activities.

Ecovillages also offer the opportunity for a live-learn experience. The idea of learning in residence is not new. It is about university students not only attending classes together but also living together; applying the theories learned to real life.

Despite the fact that ecovillages are working from the bottom up, the reality is that there is still the larger regulatory framework beyond the ecovillage that is working from the top down that must be dealt with. This is particularly true when it comes to the built environment. Ecovillage developments are constantly pushing for change in land planning and land use as well as building codes, which is an important step towards a social change.

There is great potential here to inform our building officials and governing bodies about the potentials of ecological design and green building techniques that ecovillages are putting to the test. By reaching out to these government officials, ecovillages are able to inform the official while also gaining some important traditional knowledge from the officials dealing with issues of life, health, safety and environmental protection.

Ecovillages are becoming centers for various cultural and social knowledge, such as healthcare, governing, education, local ecology and indigenous knowledge. The Farm in Tennessee is the home of a large midwife center. They have worked for decades with women who come to the community to give birth and learn about taking care of their child. The midwifery center also helped in the adoption process for many of the children born of mothers who were not able to care for them.

Ecovillagers acknowledge the need for people to feel supported, and to have a sense of belonging to a group. People in an ecovillage have the chance to be seen and heard which helps instill a sense of empowerment in the members. People are able to make decisions affecting their lives and that of the community. The sense of community is about “recognizing and relating to others, sharing common resources, and providing mutual aid, holistic and preventative healthcare, meaningful work and subsistence for all, promoting unending education, unity through respect, and fostering of cultural

expression." (GEN). Along with community support, there is also a focus on cultural and artistic enrichment and expression which has great transformative power for those working towards self-realization.

Building personal relationships within the ecovillage is imperative for the place to be whole. This building of relationships can be quite intentional in many ecovillages and in others very natural. These relationships are encouraged through things such as mutual support, shared common spaces as well as shared tools and materials. Mutual support can be found at very basic levels within the ecovillage communities. It includes activities such as sharing childcare, sharing meals, creating support groups for those going through a hard time. Shared commons are spaces that are owned by everyone and shared by everyone for all types of activities such as gardening, hiking, swimming, and gathering for celebrations. Shared commons often include buildings as well, such as a community kitchen, a dancehall, a place of worship, or a meeting hall.

At the group level, ecovillages often work at conflict resolution and consensus building. This reflects the desire of these villages for peace, justice and equity. Governing at this small scale helps to give everyone a voice, which can be very empowering. By empowering people at this level there is the potential for communities to rise up and become healthy and self sustaining environments. The models for conflict resolution and consensus building that are being developed in ecovillages are truly being put to the test and have the potential to be shared with the greater community, and government at the local, state, federal and global levels.

Zegg, an Ecovillage in Germany, works with and teaches models for mediation, called the Social Forum. There are countless ways in which ecovillages embrace social change, and work together as a community. But what is most important is their willingness to experiment with these alternatives and share their results with the public.

The fact that these villages wish to be self-governing leads to the need for actual physical spaces to meet. It is in these spaces that people are able to share their thoughts and ideas in an atmosphere of equality and mutual respect. More often than not, these meeting spaces within the ecovillage lend themselves to being circular in design. The circle helps to encourage the feelings of equality, as there is no hierarchy insinuated. The

circle also allows for people to fully see and hear each other as they speak their minds, allowing for a more complete form of communication.

Economics within an ecovillage means working towards self-reliance, to produce one's own food, energy and products and to share and trade these within the village. Creating and maintaining jobs on-site at the ecovillage has many benefits and results in design solutions. One of the greatest benefits, as described in EF Schumacher's *Small is Beautiful*, is right-livelihood, which is based on the three-fold Buddhist principles of work, "to allow humankind to utilize and develop their faculties, to allow humans to overcome their ego-centeredness by joining with others in a common task, and finally to create the goods and services needed for existence."[45] The desire to provide for their own needs and right-livelihood should be reflected in the design strategies for the ecovillage. This would include mixed-use zoning allowing for workshops and retail spaces attached to homes, as well as community centers for economic development. These spaces do not exist only inside buildings, but on the land, and in cyberspace as well.

There is a general desire to keep economics within the ecovillage internally focused, recycling that energy within the community itself, but there is also a recognition that the ecovillage is integrally connected to the outside world, some more so than others. For those villages with the need and desire to connect economically with their bioregion and the global economy there is a need for physical market spaces at the site or to connect with other local markets in order to distribute goods and services and to bring needed goods, services, and finances into the ecovillage. These market spaces can be very real or very ephemeral with modern technologies, such as cell phones and internet.

Jonathan Dawson mentions the village of Brithdir Mawr in Wales which has made its mission to show that it is possible to make a living from one's own land. "They produce basketry, rustic gates, turned wood, spinning, weaving, and felt making. They also produce food items from the land such as wines and pickled veggies."[46] The Farm in Summertown, TN is a good example of community based economics at work. They

[45] Schumacher, *Small is Beautiful*, 38.
[46] Jonathan Dawson, *Ecovillages, New Frontiers for Sustainability* (White River Junction, VT: Chelsea Green Publishing Company, 2006), 40.

currently advertise a book publishing company, various online catalogs, a Bed and Breakfast, a soy dairy, mushroom farm, multimedia specialists, tempeh lab, midwifery workshops, fresh food market, and classes offered through Gaia University, not to mention the more than 13 non-profits that were born out of The Farm.

Arts and crafts also help to create cultural ecology. Traditionally, indigenous peoples used what materials they had offered by their natural environment to create art and crafts. Not only does deriving art and crafts from local materials offer an opportunity to create small scale economics from the natural environment, it also offers a chance to teach about local vegetation and materials.

There is a recognition among ecovillages that there is no village without people and that in order to better care for the earth, the humans must be nurtured as well. Whether it is through economic stability or just good friendship and mutual support, these ecovillages are helping create places for human culture to flourish and develop in a way that is supportive of a healthy physical environment as well.

Case Study 2: Ecovillage Ithaca

Ecovillage Ithaca began on their journey of spreading ecological consciousness in the 1992 when they established their community, in Ithaca, NY based on the principles of outreach and education. It was their goal to be a living demonstration of what it means to live a sustainable lifestyle and "to develop an alternative model for suburban living which provides a satisfying, healthy, socially rich lifestyle, while minimizing ecological impacts." [47] Although Ecovillage Ithaca is known for their work in the cultural/social arenas, they have also done considerable work in "green" building and continue to update the ecological design of their site. They are currently a community of 102 adults and 60 children living a co-housing lifestyle together.[48]

Culture

Ecovillage Ithaca's success with group work has most likely been the result of

[47] www.ecovillage.ithaca.org (accessed Nov 2008)
[48] Ibid.

their choice to live in close proximity to one another in townhomes. The health of the environment and the ecological footprint of the village were paramount in many of the decisions regarding the site, which includes a wide variety of learning opportunities ranging from co-housing living to land conservation. The act of living in a village offers opportunities for learning in various areas of social ecology, such as strategic planning, consensus decision making and conflict resolution.[49] (See fig. 8.)

Figure 8. EVI Group Work
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

As a group they are very focused on personal growth and the social growth of the community itself. Because they live in co-housing neighborhoods (See fig. 9.) there is often a more intimate relationship between neighbors, which offers mutual support during times of change and growth in one's life such as birth, death, divorce, and aging. They have found that "self-reflection which leads to personal learning and growth"[50] is often enhanced when one lives in a close knit community. It is not only harder for one to hide from personal problems in this type of setting, one is actually encouraged to reach out and share their problems with the community which is there to offer needed support.

[49] Liz Walker, *Ecovillage at Ithaca: Pioneering a Sustainable Culture* (Canada: New Society Publishers, 2005), 161.
[50] www.ecovillage.ithaca.org (accessed Nov 2008).

Figure 9. EVI pedestrian pathways in townhouse development
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

There are many aspects of the site that help to encourage strong community connections demonstrating mutual support. For instance there are various shared spaces such as the community root cellar and the office resource center for cottage industry support. There is also the sod roof sauna for 15, which not only offers a place of togetherness, but also acts as a display of "Green" building techniques. The community also maintains their own newspaper, helping everyone stay informed and involved in the events and happenings in the community.

Meals are shared a few nights a week and residents volunteer 2-3 hours per week in the ecovillage on teams such as outdoor maintenance, cooking, finances, governance, and so on.[51] Other ways they share is through crafts nights, music swaps, and dances. They are also spreading knowledge through seasonal celebrations such as the annual May Pole Dance and "Guys Bakin' Pies", a celebration of the wild blackberry and black raspberry harvest. (see figs. 10 and 11).

[51] http://www.ecovillage.ithaca.ny.us/

Figure 10. **"**Music Night" at EVI in the home of one the residents
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Figure 11. EVI "Guys Baking Pies"
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

They often practice the "trial-and-error method of learning" within the village. They admit to researching and looking to professionals for ideas, but most of the time it is just "everyday life and living together as a community that offers the best lessons." [52]

[52] Walker, *Ecovillage at Ithaca.*

Education of the children in the community is encouraged in a variety of ways. One of which is the common playing center, where all the children of the village can come together to play but also to learn to "share, to develop mental and psychological powers and just get generally socialized."[53] Children and youth are integrated fully into the lifestyle at the ecovillage, allowing them to gain a holistic education from the start, regardless of what type of schooling they receive elsewhere. (see fig. 12).

Figure 12. Youth education in an outdoor classroom at EVI
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Soon the children at the ecovillage and in the surrounding Ithaca area may be able to attend an alternative high school at EVI. The plans are to incorporate 75-100 students into a high school learning environment where sustainable living and holistic learning are the main focus. The curriculum will focus on the local bioregion and the issues affecting the place where the students actually live.

Ecovillage Ithaca works on educating the public in many ways. They offer up their homes and lifestyle during tours of the site in order to educate people about living a sustainable lifestyle. They also hold conferences and workshops on various topics that are open to the public. The topics are across-the-board, including "work, play, parenting, housing, food production, energy use," but all are focused on sustainability.[54] Not only

[53] Walker, *Ecovillage at Ithaca,* 190.
[54] Walker, *Ecovillage at Ithaca,* 168.

do they hold conferences at their site in New York, they also attend and facilitate conferences in various other regions of the world. They are able to educate a global audience as well as a local one through the use of media and technology.

Ecovillage Ithaca works hand in hand with interns, graduate students, and students doing independent study. These relationships with the universities and their students are mutually beneficial. The students are able to learn in a hands-on holistic atmosphere combining both theory and practice while working with the members of the ecovillage enabling real-life feedback on their ideas. The community at EVI is then benefited by the new ideas and objective observations coming from the students.

Ecovillage Ithaca has had a close relationship with Cornell University and the Center for Religion, Ethics, and Social Policy (CRESP), an affiliate of the university. In order to create a strong connection with this very prominent university, Ecovillage Ithaca decided to create a mission that fell in line with the mission of CRESP, which was to "foster vital and caring communities to provide a foundation for world peace, mutual understanding, and respect for all life."[55]

EVI worked solely with Cornell during their first couple of years and then developed a relationship with Ithaca College Environmental Studies Department as well. This relationship resulted in a grant of $149,000 from the National Science Foundation to help develop curriculum on the "Science of Sustainability".[56] EVI now has over a dozen of their full time residents who teach courses, give lectures, and supervise student project teams.[57] It is part of the mission of EVI to continue to work hand and hand with Ithaca College in the promotion of sustainable development through education. This relationship has been a learning experience in itself. The college has had to learn patience for the informal culture and learning environment of EVI. While the college has learned flexibility, EVI has had to work within the rigid confines of academia when creating projects that worked with the villages setting and belief systems.[58]

Due to the success of this relationship and the possibility of reliable financing for educational purposes, EVI has developed some long term plans. These include the

[55] Walker, *Ecovillage at Ithaca,* 167.
[56] Ibid.
[57] Ibid., 180.
[58] Ibid., 184.

design and construction of the "Ecovillage Education and Research Center", further development of curriculum, more administrative support, and additional housing for students and interns so that they may enjoy a live-work-learn experience. Another goal, more related to the immediate community would be the construction of the alternative high-school.

It is interesting to see what lessons EVI has gleaned so far from their experience working with the universities and their students. There are six lessons mentioned. The first lesson they have learned is that students learn well from hands-on projects that are combined with theory. They find this idea similar to that of "service learning" that is becoming more popular in the university system and in high schools. The second lesson is that when students from outside the ecovillage are involved in projects for the benefit of the village it is important that someone from the village take the lead as the coordinator for the project group. They also expect that this coordinator should be paid for their time. The third lesson is that "real-life" projects offered students invaluable feedback and support from the ecovillage community. The fourth lesson is one of size. Their experience has found that groups of 3-6 students work best for the type of projects they are working on. The fifth lesson is regarding the length of the projects. They have found that projects lasting multiple semesters have a greater effect and more chance of success than a project only lasting a single semester. And the final lesson is one in quantity. The community at EVI is involved in a wide variety of projects, not to mention their own jobs and families. It has been found that there is a high level of burnout among the residents if there are more than 3 student projects going on in one semester. It is recommended for students to have interesting, interactive presentations as well as offerings of food in order to increase community participation.[59]

EVI and Ithaca College are also working together to help their home of Tompkins County of achieving its goal of becoming a sustainable community. Together, EVI, Ithaca College , and the Town of Ithaca put together a workshop entitled "Sustainable

[59] Walker, *Ecovillage at Ithaca,* 176.

Tompkins County" which hosted 40 local leaders in business, education, government and the non-profit sector.[60]

Not only has EVI worked with their local government, they have attracted government officials from around the world who have come to the village to research new ideas in community planning. For example, they have had a delegation of architects and planners from the United Kingdom and Germany and a group from the Canadian Mortgage and Housing Corporation looking to help set standards for housing in Canada.[61] They have also had inquiries from various planning departments across the US, including Hawai`i, Albuquerque, and Saskatchewan.[62]

It is possible to visit EVI for a day, for a few days, a few years, or a lifetime. A visit to EVI could mean volunteering your time working alongside community members in the organic gardens, or it could mean attending many of the workshops offered in the area of sustainable community design ranging from social ecology to ecological design.

EVI has been involved with global conferences as well. One of which was held at their sister village in Yoff, Senegal. Yoff is a 500 year old fishing village that is facing the ever present westernization. By combining forces, the two villages have become teachers for each other. The people from EVI wanted to learn the traditions of a village that was already living a sustainable lifestyle, although one that is being threatened. With westernization of Yoff inevitable, the people from the EVI group were eager to share their knowledge of options for sustainable development, such as renewable energy and wastewater treatment.[63]

This relationship led to other major educational opportunities and the spread of the knowledge of sustainability. EVI together with the village of Yoff worked with the Yoff's town of Dakar in hosting the 3rd annual Eco-City Conference in January of 1996. This conference helped to spread the knowledge of sustainable development to many of the other villages surrounding Yoff.

Yoff is spreading ecological consciousness in other ways as well. With the financial and administrative support of the Global Ecovillage Network (GEN), in which

[60] Ibid., 182.
[61] Ibid., 201.
[62] Ibid., 203.
[63] Walker, *Ecovillage at Ithaca,* 193.

EVI is highly active, and the United Nations (UN), the village of Yoff has been deemed a "Living and Learning Center". This allows them to host a dozen or more international students who come to work with the students in Dakar researching ecological solutions to village problems.

EVI sees education as a promising cottage industry for their community, where fees for workshops and classes could offer employment and income for many of the residents. At the same time this cottage industry would be an extraordinary outlet for all the accumulated knowledge that the people at EVI have and are generously willing to share. The community also hosts a wide range of businesses that were started and are run by the various residents. There is natural healing, green consulting, B&B services, the organic farm, and the list goes on. Many of these businesses offer opportunities for teaching and learning both within and outside the community.

The Physical

EVI has on its site two separate co-housing neighborhoods, and a site designated for a 3rd in the future. The First Residents Group (FROG) designed their homes with the help of an architect and construction firm. For the 30 units, there were 5 design options used that are all based on principles of passive solar design. They range in size from 900-1650sf. These homes were designed like townhomes. This allowed them to save more land from development, to share walls for thermal and material efficiency, and to have a smaller infrastructure which saves money and energy. The FROG common house includes a kitchen/dining, children's play room, sitting room, 10 private offices, guest room, multi-use room, teen room, laundry, and storage. (see fig. 13).

The Second Residents Group (SONG) also created a compact co-housing neighborhood. They apparently had more input into the design of their individual homes than FROG, but this ultimately led to cost overruns, putting a damper on their dream of creating affordable housing. They have 15 duplex units as well, for a total of 30 homes (see fig. 14). They are using 3.5 acres and preserving another 1.8 for green space. The third neighborhood,TREE, is currently in the design phase. Currently a few of the homes located in these co-housing neighborhoods are offering B&B accommodations to visitors.

Camping is also allowed by some visitors. There are future plans to create more housing for students and interns.

Figure 13. EVI housing in the FROG neighborhood
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Figure 14. EVI duplex housing in the SONG neighborhood
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Some of the ecological aspects of their built environment include a water tank and pump station for their shared water supply. They are currently working to improve their heating, energy, and waster water systems by implementing wind power and grey water recycling as well as a future onsite bio-diesel crop production and processing. Currently FROG has a district heating system run from the common house and ½ of SONG

residences have solar electric panels, both important steps to energy independence and efficiency.

Ecovillage Ithaca made a conscious decision to be near town in order to reduce miles traveled in cars as well as to allow for the use of alternative transportation such as the bus, walking or biking into town. This was a conscious decision based on the realization that despite their efforts to be sustainable, they were still dependent on the city for many of their needs. They are also planning a future car and van shuttle to and from the site. Currently there are accommodations for bicycles on the site.

Unlike Ecovillage, Ithaca, many ecovillages choose to be in totally rural settings. This goes against many of the principles of Smart Growth, but due to the cooperative nature of the Ecovillage, miles traveled in the car are naturally reduced. With open communication, people in the village combine shopping trips and cars are also shared, cutting down on the amount of embodied energy needed to provide transportation for the whole. And to the approval of the New Urbanist, many of the daily needs of the ecovillager that would normally require driving, such as entertainment, school, stores, dining, daycare are provided on site.

EVI is working with professionals to design the EVI Education Center. Working with a design professional helped the village understand what new spaces they needed and how those spaces could be multifunctional, saving land, money and energy. The idea is to create a Village Center which will be a flexible space that combines the needs for a performance space, classrooms, community gathering space, basketball court, and conference capabilities.

They also have adopted a land use zoning system for their site that has had various beneficial outcomes. Of the 172 acre site, 80% is to remain green space, 55 acres of that deemed conservation land under the Finger Lakes Land Trust. The land conservation areas include habitat restoration, a wild meadow and 2 ponds used for swimming, skating, fire protection and biodiversity (see figs. 15 and 16). There are multiple hiking trails to help people connect with the nature.

Figure 15. Wild meadow conservation land at EVI
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Figure 16. Wetland conservation and swimming hole at EVI
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

There is also land designated for agriculture, which includes 2 functioning greenhouses, community compost sites, barn, chicken coops, beekeeping, a potato patch, and the 10 acre Westhaven Farm, an organic CSA vegetable farm (see figs. 17 and 18). They also have a wild berry patch and organic CSA/U-pick berry farm. The land use plan includes spaces for future projects such as a fruit and nut orchard, a place for husbandry of sheep, goats, chickens and llama, and a natural cemetery.

Figure 17. Greenhouse for the Westhaven organic farm located at EVI
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Figure 18. Produce from Westhaven, the organic farm
Source: http://www.ecovillage.ithaca.ny.us/vlife/village.html (accessed April 22, 2009)

Chapter 6: Ecological Consciousness in the Physical Environment

As our culture and philosophies begin to reflect our desire for sustainability, the places where we dwell must also begin to reflect our highest aspirations. As our buildings begin to step more lightly on the land they should also become tools for learning for the residents and visitors. There is a drastic need for our built environments to adhere to the principles of ecological design. Ecological design strategies have been known since the beginning of human history, but have not always been applied. As the need for a sustainable future becomes more imperative, ecological design strategies will continue to be pursued by professionals and laymen alike. describes The major principles described by Sim Van der Ryn in *Ecological Design* are that "solutions should come from place, ecological impacts of design should be considered, we should design with and not against nature, everyone has important input into the design of their community, and the nature of things should be made visible through design.[64] Many theories and movements in design and planning fall under the umbrella of ecological design, such as "Green" building, sustainable design, Permaculture, conservation, preservation and restoration, to name a few.

Architecture is one of the greatest reflections of a culture. In order for our architecture to become a working part of our ecosystems, no longer harming, but possibly healing, then like our cultures our architecture "should rise out of the place" where it is located. When we try to tackle environmental protection on a global scale it becomes an incredibly complex matter. Though we must work on the issues at a large scale, it is also important to understand the issues at a very small scale, such as within ones own bioregion. This type of understanding at a small scale helps to empower every individual to do their part in protecting our environment. It helps to keep the issues in our face, not allowing them to be pushed off on some big corporation or state agency.

Gaining a deeper understanding of the place, or bioregion, includes observing the climate and natural forces, but also the culture of the place. It is necessary to consider the

[64] Sim Van der Ryn and Stuart Cowan, *Ecological Design* (Washington, D.C.: Island Press, 1996), 57-160.

knowledge of the indigenous and traditional people. There is great value in local knowledge that can lead to more appropriate design choices, such as which plants grow well, where and when does the stream flood.

There are many reasons for designing with nature, the one of grave importance to us today is the ability to reduce the harmful impacts that human development is having on natural ecosystems. When visiting a site, no matter what one's background, the first things noticed are the sun, wind, water, views and sounds. This sort of initial site analysis is the beginning of "designing with nature." This is the understanding of the underlying and the exposed forces of nature that will have varying impacts on the site and the people that are going to be living there.

The industrialization of the world led to a belief that nature could be conquered by man and his great machines. Humans have moved earth, rerouted waters, and cut down entire forests in their efforts to design against nature, which has ultimately led to the sickness of both the planet and our selves. The advent of Modern Architecture that grew out of the Industrial Revolution's glamorization of the machine has been the antithesis of this ecological design strategy. It was the Modern movement in architecture with its big glass boxes meant to be located anywhere, or nowhere, that has caused our buildings to be one of the greatest consumers of resources on the planet. Ignoring that a building should respond to a particular place or climate reflects the lack of understanding about cultural ecology.

Learning to understand nature and her processes makes it possible to incorporate nature's design into the overall scheme of our designs. For instance, the sun's energy can be borrowed for electric power, and wetlands can be preserved and restored to once again act as a natural water filter. We must consider the need to preserve biodiversity, hydrological systems, soils, and the list goes on. There is a need to respect these systems and allow nature to be at its best, natural.

One of the major benefits of designing with nature is the potential to save energy. This is not just energy in its most refined formed, but also embodied energy. For decades our current system of economic accounting has failed to include the natural environment into the equation. We have been treating nature as if it were a free source of capital, which has helped to make the bottom-line look rather impressive. When we include

nature into the equation it is known as ecological accounting. This type of bookkeeping takes into account "acres of abused land, kilowatt-hours of electricity, gallons of water, pounds of eroded soil, and all the other environmental impacts of design."[65] Ecological accounting encourages the use of recycled, rapidly renewable, and local building materials as well their recycling, in order to make the circle complete.

Environmental impacts can be calculated into acres of land needed which is known as the ecological footprint. Although the estimates vary, the typical ecological footprint of someone in the modern western society is considered to be between 10-20 acres. At that rate, it would take 2-3 planet Earths to support the rest of the world at the same standard as the people in modern western society. Not only is this a display of the great social inequities of our time, but this fact also puts into perspective how dire our situation really is.

Allowing for ecological accounting in our designs is one of the major premises behind the various rating systems that are now being used in the construction industry. Rating systems such as *LEED* and the *Living Building Challenge* are encouraging designers to apply the principles of ecological accounting, letting them "inform the design."[66] In terms of economics these ecological rating systems have become powerful marketing tools responding to the changing worldview of our natural environment. The buildings designed to use less resources and energy over time can show a considerable economic payback as well. As more and more buildings adhere to the principles of ecological design and "Green" building, the market will be able to offer these ecologically sound options at a reduced cost, as the result of supply and demand.

Changes in the market will allow people to make better, more informed choices in their designs, in fact, "everyone is a designer". First, by actively participating in daily life we are affecting the design of our environment. Each choice we make on an individual level has the potential to cause some sort of change in the design. People need to recognize how their personal decisions and activities help shape our environment. Everyone plays an active role in the design process.

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[65] Van der Ryn and Cowan, *Ecological Design*, 83.
[66] Ibid., 82.

Sustainability must come up through the grassroots level as well as from the top down. Many communities are encouraging and some are requiring that members of the community be invited to participate in the design process, whether for their town master plans, or the development of a new subdivision. By participating and staying informed people are given back control over their own environments and are more empowered to protect them.

Another way to empower people to protect the environment is to *make nature visible.* This is not just about having a scenic view, although that can go a long way towards creating an ecological consciousness. Making nature visible refers to the true nature of things. "As nature has receded from our daily lives, it has receded from our ethic."[67] Our built environment should reflect the nature of things so that we are not living in a world of denial. "Making nature visible" is about honesty. If our built environment is full of illusions, hiding those things that we wish to ignore, then we will not be able recognize what is working and what is causing problems. We will not be able to understand the processes of nature if the true nature of things is hidden from us. Nature has the potential to be one our greatest teachers, making us aware of that which sustains us. Being close to and in contact with nature also provides a certain nourishment for the mind, body and soul. This phenomenon is often referred to as biophilia. What person does not feel a sense of renewal and peace when spending time in an idyllic natural environment?

The design of our built environment has a huge impact on what type of relationship humans are going to have with the natural environment. If our goal is that of a sustainable existence then our built environment must start taking into account environmental impacts. As our built environment begins to reflect our ecological consciousness, through energy and resource conservation, it should also act as a teacher, ready to inform any visitor about what it means to live in harmony with nature, to live a sustainable lifestyle.

[67] Van der Ryn and Cowen, *Ecological Design*, 160.

Ecovillage Physical Environment

The reviving of an ecological consciousness must happen at a cultural level, therefore it is natural that this consciousness manifest as a village. "A village is an organism that literally builds itself, feeds itself, and today would also grow and collect their own fuel and energy."[68] Ecovillages have become the testing ground for ecological design strategies. Ecological design within the ecovillage focuses on people as they connect with the living earth and enjoy daily interactions with the soil, water, plants and animals. It means that people recognize that food, clothing, and shelter are provided by the soil, water, plants and animals. There is a general respect for the cycles of nature. Food is often homegrown using organic methods. Homes are often constructed out of local materials, and energy is often provided by a village based renewable energy system. Biodiversity protection is taught and ecological business practices are fostered. There is a need to assess the life cycle of all products used to truly understand their impact on the environment. Air, water and soil are preserved through proper energy and waste management. Other priorities are native land protection and safeguarding of the wilderness.

Ecovillages are becoming centers of bioregional knowledge and action. By focusing on their regions they are able to put traditional knowledge to use and are more empowered to take better care of the land that is beneath their feet. Ecovillages offer a great opportunity to restore our local ecosystems. The Auroville ecovillage in India has its own center for scientific research and has become a seed bank for local medicinal plants. Not only do they have a seed bank, but they have also restored their site which was devoid of vegetation. They started by controlling water runoff on the site and, to date, have planted over 2 million trees, restoring their local ecosystem to health.

Reduction of energy use is met on many different levels in the ecovillage, as is energy production. It is not just solar panels creating the energy in some of these villages. For instance, in the ecovillage of Old Bassaisa, Egypt, founded some 5000-10,000 years ago, they have implemented an onsite methane gas producing unit. This is an efficient use

[68]Sim Van der Ryn, *Sustainable Communities: A New Design Synthesis for Cities, Suburbs, and Towns* (San Francisco: Sierra Club Books, 1986), 57.

of the waste from their livestock, which saves on things like other fuels and firewood. While many ecovillages choose to be off grid, not all are looking to be so energy independent. For example, the ecovillage of Kibbutz Samar, Israel, founded in 1977, has worked with the national electricity board, which has finally agreed to let Kibbutz Samar hook up their large array of solar panels to the national grid, to do what is known as net-metering. This allows them to have clean power, without the dirty batteries that often come with it. It also offers a backup energy source when they cannot meet all their electricity needs with solar. Kibbutz Samar actually has plans to have the largest net-metering solar array in Israel.

Ecovillages have been experimenting with alternative building materials for years, both out of necessity and experimentation. Many ecovillages, because of location and economics, have no choice but to use local building materials. Take for example the ecovillage of Sieben Linden, in Germany. They first moved to their site in gypsy wagons (some still live in them). Eventually they began building structures that use less energy to heat. They used local straw and mud to create these super insulated structures, and according to the *Schumacher Briefings*, Sieben Linden has the largest straw bale structure in all of Europe. This group is really pushing the envelope in their region of Germany, by forcing building officials to deal with their alternative methods of construction. Earthhaven in North Carolina, uses timber from their site, mills it and uses it for construction, and then regrows the forests. Not only do they use local timber, and straw bale construction, they also construct buildings out of entirely recycled materials, or as they refer to it, “junk”.

Ecological design can be taught in many ways, and ecovillages are making sure to take advantage of all the ways. They are teaching by example by demonstrating comfortable living in a built environment where sustainable strategies are being put to the test. They are teaching by allowing people to come and tour their homes. They are sharing stories of how they achieved their goal and the many benefits of living “green”. The buildings themselves are treated as living laboratories where the students can actually experience what it means to live and learn in a sustainable space. People who visit these villages often go home to teach their new knowledge to friends and family and to apply it in their own lives. Ecovillages are teaching “green” building in workshops

and accredited college classes held on their sites, as well as going out into the surrounding communities and around the world to teach and learn more ecological design strategies. Many schools and universities are able to incorporate these ecological design strategies ideas into their curriculum.

Ecovillages are designed in a way that the members are able to have a direct connection to the land that sustains them. There is recognition that humans need to be well acquainted with the land that feeds them. Most ecovillages have a strong agricultural component that focuses on organic production. Ecovillages across the globe are practicing various techniques for food production that are appropriate for their climate and needs. These methods of appropriate agriculture techniques can be found in the theories on Permaculture outlined by ecologist Bill Mollison. The first ecovillage in Italy, Upacchi, grows herbs as a cash crop, but also have fruit orchards and olive trees. They practice organic methods and replenish their soil through methods of composting. A chestnut forest was also rented to some of the community members, which they cared for and harvested for an annual cash crop.[69] The Kibbutz Ketura in Isreal is another ecovillage that is working with their local climate and soil types to produce food. They are located in a high drought area, or rather a desert. They took this as an opportunity to do research into drought resistant crop production. The desert location actually was a benefit due to the fact that it had not been previously used for modern agricultural practices. This left the land free of agricultural or industrial pollution. It is of particular importance that medicinal plants be free of toxic chemicals, for obvious reasons. This naturally organic setting allowed this village to start growing medicinal plants that are processed and sold around the world.[70] Most ecovillages have incorporated small scale organic farming operations to help provide sustenance for the members with excess being sold at small stands, or farmers' markets.

Ecovillages are doing invaluable work in the research and development of ecological design strategies. By acting as living laboratories they are able to assess what works and what does not when ecological design meets culture and philosophy. If there is ever a question about renewable energy production or alternative building materials the

[69] Bang, *Ecovillages*, 132.
[70] Bang, *Ecovillages*, 146.

answer could quite possibly be found in an ecovillage somewhere. The open atmosphere offered by most of these communities allows for their valuable work in the areas of "green" building as well as conservation, preservation and restoration of their local natural environments to be shared with the surrounding community and the world.

Case Study 3: The Lyle Center for Regenerative Studies at Cal Poly Institute

Construction of The Center for Regenerative Studies, on the campus of the California State Polytechnic Institute (Cal Poly), began in 1993. The idea for the center was conceived as far back as 1976. The Center is located on 16 acres within the campus of Cal Poly. At first glance, The Center seems to be mostly focused on the physical aspects of ecological consciousness with their very efficient ecological design strategies that are immediately apparent in the structures and in the land use strategies. The real focus of The Center is not just technical research of sustainable systems. The students are encouraged to live on the property during their studies in order to synthesize the learning experience, taking learning out of the textbook and applying it in a way that social interactions can also be evaluated in terms of potential sustainability. The Center "grows its own food, generates energy, regulates its own thermal comfort, and recycles waste."[71]

The Physical

Dr. Lyle gives credit for the concept of a "regenerative system" to author and organic gardener, Robert Rodale, who recognized the ability to regenerate soils so that they are healthy and viable without the use of chemical pesticides and fertilizers.[72] A regenerative system is as close to a closed loop system as possible; where the waster byproducts of the system become the actual fuel that sustains it. Many of the principles of John Lyle's theory of regenerative design are shared by proponents of ecological design. There are many people out there doing the same work but under a different title.

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[71] John Tillman Lyle, *Regenerative Design for Sustainable Development* (New York: John Wiley & Sons, Inc., 1994), 15.
[72] Ibid., 10.

The following is a list of the design strategies applied in the design of the Center for Regenerative Studies: "Let Nature do the work, Nature offers solutions and context, allow for integration of functions, using appropriate technologies, incorporating human culture and intelligence as part of the functioning systems, diversity of systems to allow for 'multiple pathways', storage methods as a way to save and preserve items for future use, allow nature to flow through site and help to determine major processes, and finally to incorporate the ability to recycle within all the processes."[73]

The energy systems of The Center were not fully developed in the design stages of the project due to the fact that they wanted to allow for an organic growth process that was fed by research and development. The major goals related to energy include: "supply adequate quantities of energy, minimize the use of nonrenewable resources, especially fossil fuels; minimize waste, including none that is hazardous or toxic; provide sustainability into the indefinite future; and to maximize community participation and control."[74] (see fig. 19).

Figure 19. Solar collectors on rooftops and wind turbine in the background at the Lyle Center
Source: http://www.apl.ncl.ac.uk/coursework/IThompson/some_new_directions.htm (accessed April 22, 2009)

[73] Lyle, *Regenerative Desgin for Sustainable Development*, 48.
[74] Ibid., 80.

Figure 20. Lyle Center for Regenerative Studies main building with community room
Source: http://dsa.csupomona.edu/uhs/regen_studies.asp (accessed April 22, 2009)

The residential facilities for the students consist of double occupancy bedrooms that are combined into suites of three or four of those rooms. Each suite shares bathroom facilities. The suites are connected by corridors that meet in a community room (see fig. 20). These community spaces are left flexible and to be used in a variety of ways. The reception room mentioned earlier contains the kitchen and dining space, and offers very intentional and inspirational "panoramic views of the campus and the San Gabriel Mountains beyond."[75] Outdoor spaces include, beside the gardens, various gathering spaces and amphitheaters, as well as lawns for lounging and gaming. The outdoor gathering spaces range from very public, near the reception center, to very private ones near the residential areas. The village was originally designed to house 20 residents, with the eventual plan to house 90 people, including students, faculty, and visiting faculty. All of the structures were designed to take into account passive and active sustainable design strategies, such as solar power, thick insulation, shade devices, natural ventilation and thermal mass (see figs. 21 and 22).

[75] Ibid., 280.

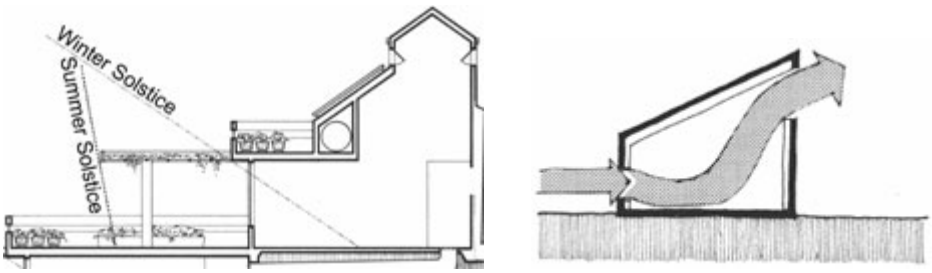

Figure 21. Sun and ventilation analysis of Lyle Center housing
Source: http://www.csupomona.edu/%7Ecrs/demobuildings.html (accessed April 22, 2009)

Figure 22. Highly insulated strawbale structure under construction by students at Lyle Center
Source: http://www.csupomona.edu/%7Ecrs/demobuildings.html (accessed April 22, 2009)

"Due to the arid conditions of Pomona California and the intensive agriculture on the site, water management is a priority at The Center. The land is manipulated considerably to accommodate for the collection and preservation of water on the site. Water is diverted for use in aquaculture, sewage treatment, irrigation for rice paddies and other crops needing large amounts of water, water for the main reservoir, and other uses functionally related to these."[76]

There was an in-depth study of the energy inputs and outputs of the site, which helped to better inform the design. This study not only included solar and wind analysis for electricity production, but also included studies into human food consumption and metabolism to help determine how much space was needed for adequate food production.

[76] Ibid., 179.

Much of the land is zoned based on the topography and the type of agriculture that is best suited for that area.[77] Water is directed and contained throughout the landscape to allow for optimal usage. They use a wetland system to purify sewage produced on the site. Members are encouraged to utilize local thrift stores to purchase items they may need, but also to donate old items for reuse. As much recycling as possible is done on site. Recyclables that cannot be handled onsite are sent to local recycling centers.

Agriculture is done in a way that preserves and rebuilds the soil while also providing ecosystems to help build up the biodiversity of the site. They practice agriculture that deals with the "urban-rural interface."[78] The land use system is based on human habitat, agriculture, aquaculture, livestock. They raise goats and cows for milk and meat, various game birds for food and weed and insect control, beehives for honey, and fish. In the tanks with the fish they also produce various edible water plants such as taro and water chestnuts. They have areas for forage crops, trees for foraging and fuel, and greenhouses. Accessory buildings such as sheds for tools, farm equipment, shops and work spaces are found throughout the site as well. They felt in the beginning that they knew little about "regenerative" agricultural processes, therefore this area of The Center offers many of the research opportunities (see fig. 23).

Figure 23. One of the many experimental gardens at the Lyle Center for Regenerative Studies
Source: http://www.apl.ncl.ac.uk/coursework/IThompson/some_new_directions.htm (accessed April 22, 2009)

[77] Ibid., 179.
[78] Ibid., 215.

The original design was eventually altered due to forces outside the university system, including the building department and the fire marshal. The fire marshal obviously was left out of the original integrated design team, which caused the design to have to allow for fire lanes that were not previously included in the site plan. The plan is to be constructed in phases so that one phase may inform the next allowing for flexibility and change that is needed in the areas of research and organic design. "[But] the importance of form goes far beyond its functional role. By adapting to the diverse conditions of the environment, landscape and architecture can give visible expression to fundamental relationships between humans and nature implicit in the regenerative process."[79]

The design process used was referred to as a "regenerative" design process. The schematic design process was made up of an integrated design team that included "two architects, two landscape architects, two agronomists, an anthropologist, an aquaculturalist, an energy analyst, a geologist-hydrologist, an agricultural economist, and two graduate assistants" as well as civil engineers, and a group of "representative" future residents.[80] The design concept was one of a human ecosystem. It was designed as a life support ecosystem for humans that represented and worked as closely to that of a natural system as possible. The site is an "intensive development of the site with a wide range of biological and cultural activities."[81] The site has a topography that allows for a variety of microclimates, each with its own unique qualities that allows for a variety of experimental horticultural techniques. All these zones include the use of polyculture, rather than the more modern techniques of monoculture in agriculture. They are not necessarily focusing on bioregional approaches to agriculture, but on using the site to replicate various regions of the globe and experiment in agricultural techniques that would better suit their particular climate.

As the design process continued there ended up being two very distinct groups. One group worked on curriculum and included many of the original group who were versed in regenerative studies. The design process was taken over by a very bureaucratic

[79] Ibid., 16.
[80] Ibid., 31.
[81] Ibid.

group appointed by the university. Unfortunately, the new design group, except for one member, had no prior knowledge of regenerative design principles and therefore was uninformed and often confused by many of the design choices that had taken place in the earlier schematic models produced by the regenerative studies group. There were issues with liability, maintenance and the experimental nature of much of the design strategy. Finally the design committee was reformed and reduced in number of members. This helped to push through many of the original conceptual designs for the project, but items such as sewage treatment were put off until later phases. On site sewage treatment is often a major environmental concern, especially for Departments of Health, Land, and Natural Resources. The more of these systems that are installed and tested, the more they will become readily acceptable.

Culture

The purpose or mission of the center is as follows: Education in regenerative studies in a learn-by-doing and living environment. The idea of people living and learning in their daily lives within the community is part of the process of developing a culture that is seen as an integral part of the entire system of sustainability, or regenerative design.[82] The center is designed to act as a demonstration project for the rest of the university and for the surrounding community. They offer tours as well as consultation to people interested in incorporating any of the ideas they see in the village in their own designs.

Indoor and outdoor gathering spaces for various sized groups can be found on the site, to encourage a culture of ecology and learning among the community members. There is a formal reception room, offering a connection between the village and the outside world. Not only does the ecovillage offer academic spaces such as lecture and seminar halls, a small library, and laboratory spaces, there is also a community kitchen and dining facilities which are considered the "heart" of the village, where meals are shared at least once a day.

[82] Ibid., 16.

Research is a major component of The Center's mission. Both the natural and built environment of The Center offer infinite opportunities for research in practically every field of learning. The Center sees itself as offering opportunities to people studying "agriculture, aquaculture, architecture, landscape architecture, engineering, and social science."[83] The Center has been designed "as a community that will explore the interactions between people and technological practices as well as the practices themselves."[84]

The curriculum committee for The Center was able to finally create a curriculum that "is uniquely suited to the unconventional subject matter but fits neatly within the university's curricular structure."[85] The graduate program was created so that the classes were not divided into separate disciplines. The first year students learn to "follow instructions and examples" and the second year they "take responsibility for leadership and development."[86] For students who wish to study particular subjects in more depth, they have created a program to allow for joint majors which combine regenerative studies with a variety of other disciplines. The courses offered by The Center include lecture, seminars, and most importantly laboratory experience which put the theory into action.

The greatest challenge for the creation of The Center was trying to create a new way of learning within an archaic bureaucratic university system with its own expectations and requirements. The Center for Regenerative Studies focuses on holistic learning experiences, where the "environment and curriculum are inseparable; [and] the environment is the teacher."[87] Although The Center has to fit into the rigid bureaucracy of the university system, which is not always a smooth process, they still believe that "among the institutions of contemporary society, the university, with its diverse range of expertise and its spirit of inquiry, seems to offer a unique setting for exploring the technological, esthetic, social, and political meanings of regenerative future."[88] The Lyle

[83] Ibid.
[84] Ibid.
[85] Ibid., 277.
[86] Ibid.
[87] Ibid., 274.
[88] Ibid., 273.

Center for Regenerative Studies is a great case study for university groups that are trying to step outside the box of traditional education systems.

PART 3 ECOVILLAGE MĀNOA

Chapter 7: Traditional Culture and the Land

Hawai`i is the ideal location for an ecovillage, with a moderate climate, temperatures hovering year round in the 80's, constant sunshine and cool trade winds allowing for the most ephemeral of architecture. With this absence of architecture comes the absence of energy consuming components of that architecture, such as embodied energy in materials, thermal comfort technologies, and lighting. The island herself provides many of the needs of the ecovillage. She provides food, water, materials, entertainment, and nourishment for the soul. With all of these provisions coming from nature, it would seem that an ecovillage in Hawai`i would be able to easily achieve goals of sustainability and elegant simplicity. It would seem that an ecovillage in Hawai`i would be able to honestly and faithfully deal with the issues of ecological design, and truly allow the reduction of one's footprint on the planet.

The traditional Hawaiian culture is well known for having had a close connection with the land, or *`āina*. When designing a sustainable community in Hawai`i, it was helpful to explore and better understand the traditional Hawaiian connection to the land and how and if they were able to maintain a sustainable existence. The unfolding of human consciousness on the island of Hawai`i was the unfolding of an ecological consciousness. The Hawaiians recognized that they were part of a greater whole, that all things are connected. They recognized that the earth took care of them, and they in return took care of the earth. Their culture was a culture of ecology, a culture that emerged out of deep sense of place.

The Hawaiians regarded nature as a brother; and each brother was obligated to take care of the other. This relationship based on love and respect for the *`āina* was no doubt one of the main reasons that Hawaiians were able to sustain an existence on these geographically remote islands. One of the early Hawaiian legends reveals how Hawaiians felt connected to their land. This story is intertwined with the creation of *kalo*, the plant that has offered sustenance to Hawaiians until current times.

The goddess, *Ho'ohōkūlani*, became pregnant by her father, god of the sky, *Wakea*. This child, which never took its first breath, was called *Haloanaka.* From the ground above the grave of the stillborn child grew the first *kalo*, or taro plant.

Ho'ohokulani gave birth to a second child by *Wakea* and was given the name *Haloa*. *Haloa* was the first human and the Hawaiians were his descendants. Since the stillborn child, the *kalo* root, was the older brother the Hawaiians were to respect and tend to *kalo* as they would any other older sibling. And like any good older sibling, *kalo* would provide his younger siblings with sustenance.

In the old days, even before the times of Kamehameha, land rights were in the hands the commoners. The lands were inherited based on burial places of the ancestors. Although the high chiefs and kings would change, the burial rights of the people remained on their lands and gave the people rights to the land.[89] The love for the land of one's birthplace was passed down from their ancestors who had also been born and died on that same land. The commoners typically did not move from place to place looking for better land, but would rather stay on the land of their ancestors despite potential poverty.[90] As their ancestors passed away their energy and spirit would be transformed into some other facet of the earth, whether an animal or a plant, and these were the *`aumakua*, guardian gods of the people. To love the land, *aloha `āina*, and to take care of the land, *mālama `āina*, came from a deep rooted connection to family and place.

The love of the land and the *`aumakua* can be found in the *mele*, songs, the *oli*, chants, as well as in the dance of the hula. These songs and chants that accompanied the hula were often love songs for nature. *Heiau*, or temples, were also built throughout the islands in order to honor various gods who represented the various aspects of the natural world.

Before 1200 CE, the village chief, who had administrative authority over the land, would have been a senior kinsman, an elder. This kinsman would have been in charge of the land and the people of the land. Land use was a family affair. Chiefs during this time were known to hold merely administrative positions over the land, and participated in the everyday affairs of the village with little "behavioral isolation" from everyone else.

[89] Kamakau, *Ruling Chiefs of Hawai`i*, 376.
[90] Ibid.

This was known as a time of minimum *kapu*, or laws, as the chiefs held little secular power.[91]

Oral traditions have revealed that great changes in landholding and politics took place by 1200 CE. Population growth is believed to be the reason that the leeward sides of O`ahu, where Mānoa can be found, began to be settled after 1000 CE. It is believed that by 1300 CE that a majority of the island had been permanently settled. The hierarchy of chiefs was becoming more complex at this time. This created a greater and greater separation of the chief from his people and kin. Lineage chiefs were replaced by outsiders. This caused the common people to lose control over their community lands as well as the loss of any family ties to the chief. The higher complexity of governing systems has led some scholars to believe that this was when the complex system of land use known as the ahupua`a began to take form.[92]

By 1400 CE O`ahu was believed to be a single kingdom. There was a continued growth of population, complexity of government, as well as an increase in large temples and temple worship. These larger temples were often located at the ruling and economic centers, places where rulers lived or visited frequently. Residences of the ruling chiefs also were known to have become more elaborate during this time. The change in political power on the island meant that the lands were distributed among the new higher chiefs after battles, but they were sending in their own kinsmen to be chiefs of these local lands. Change in land holdings from kinship ties to a hierarchy of chiefs sent from outside of the family was the beginning of the disconnect of the people from their land.

This was especially true on O`ahu. The O`ahu Kingdom fell with the invasion by the Maui Kingdom in 1783. Battles between chiefs of the various districts of O`ahu continued until Kamehameha I of the Kingdom of Hawai`i invaded and defeated the Maui chiefs at the Nu`uanu Pali. The *maka`ainana*, people of the land, were quickly being killed in wars and their chiefs replaced by those from other kingdoms, reinforcing the loss of control by the common people of the land of their ancestors where they had their original burial rights. The loss of land ties during the times of Kamehameha was

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[91] Ross Cordy, *The Rise and Fall of the O`ahu Kingdom: A Brief History of the Island of O`ahu* (Honolulu: Mutual Publishing, 2002), 15.
[92] Cordy, *The Rise and Fall of the O`ahu Kingdom,* .

nothing compared to the loss of the land and culture experienced when foreigners began to settle the islands in the late 18th and early 19th centuries.

Although Hawai'i and Mānoa have a history of loss of traditional culture due to wars and changing power structures, the 20th century saw the return of an interest in traditional relationships the people once shared with the land. This shift took place in the 1970's and early 80's. The launch of the *Hokule`a*, a traditional Polynesian sailing vessel, in 1975, was the mark of a renewed interest in ancient Hawaiian culture that had slowly vanished in the previous 200 years. The year after the *Hokule`a* set sail, the restoration of the island of *Kaho`olawe* began. This island had been used for target practice for decades by the US Navy. This island has significant cultural value to the Hawaiian people. Restoration of the island of *Kaho`olawe* has been a reflection of renewed love not just of the *`āina* but also of the traditional Hawaiian culture as well.

This rising awareness of the need for the renewal of indigenous cultural values was demonstrated in Mānoa in 1976 when plans were submitted to the city to recreate the ancient Hawaiian foot path from the mountains to the sea along the Mānoa Stream. The plan was not realized, but there has been renewed interest in the plan lately by Mālama o Mānoa.[93]

One modern movement towards an ecological consciousness within the valley took place in 1980. Students from the University of Hawai`i rediscovered the once revered spring, *Kānewai*, waters of the god *Kāne*. Its "discovery" led to the creation of a group called the *Ho`okahe Wai Ho`oulu `Āina*. They cleared the land to reveal the ancient *lo`i*, or water gardens. The adoption of the group by a kupuna, or elder, led to even more opportunities to raise consciousness in the valley and in the islands. He taught them ancient farming techniques as well as some very important traditions that could perhaps help to restore the kindred relationship between humans and nature that used to take place in this valley. He taught them about *mālama i ka `āina*, caring for the land, *mahalo i ke akua*, gratitude to the spirit, and *aloha kekahi`i kehahi*, to love one another.[94] All values that could help lead us out of our current degraded relationship with our natural world. They not only were able to revive some traditional values from this

[93] Manoa Valley Residents, *Manoa*, 205 .
[94] Manoa Valley Residents, *Manoa*, 117.

process but also to introduce some native plants that would have most likely been grow in the same place by the ancestors, such as “taro, `uala, `ulu, uhi, mai`a, niu, kukui, hau , ko, ohi`a-ai, wauke, and native hibiscus.”[95] Eventually this site would became the home of the Department of Hawaiian Studies of the University of Hawai`i.

[95] Ibid.

Chapter 8: Site Selection

The University of Hawai`i

In the case of this academic exercise the focus is the design of an ecovillage. Choosing a location for the ecovillage is the primary design consideration. The concept of this particular ecovillage is to create an environment that allows for the teaching and learning of an ecological consciousness at the cultural/social level, spiritual/personal level and ecological/physical level. In this particular case, it was important to try to understand how this ecovillage could have the greatest educational outreach to the surrounding community and the world. The site needed to be in a physical location that allowed for the benefits for ecological design strategies, especially that of bioregionalism. Finally, it was also important to find a place that could benefit from the healing potential an ecovillage will bring to the land.

Sustainability does not belong to any particular branch of science, philosophy, or design. In fact, sustainability is highly dependent on every aspect of our lives, this means not only learning sustainability, but also living it. This calls for a new type of campus and a new type of curriculum that brings theory into practice in a residential experience. The University of Hawai`i at Mānoa wishes to establish a curriculum and degree around the topic of sustainability. The desire of the students, faculty and administration of the University of Hawai`i to create a degree program based on sustainability makes the school a perfect candidate for the concept of an ecovillage. The choice to base the ecovillage design around a degree program in sustainability at the University of Hawai`i has many benefits. One of the greatest benefits is the academic connection. The constant influx of students and guests focused on the issues of sustainability will allow for the constant influx of energy necessary to keep projects going and to keep new ideas generating. This energy that is maintained through education has the potential to be exponential when various departments of the university are able initiate cross disciplinary research projects in sustainability, with ease, through the ecovillage program.

A look at the history of education in Hawai`i and in Mānoa gives some important clues to the connection between our knowledge systems and our ability to live a sustainable existence. The desire of the ecovillage to provide a holistic educational experience reflects the traditional educational system of the Hawaiians which saw nature, knowledge, and crafting as a shared experience.

History of Education in Mānoa

The deep connection to the earth that the Hawaiian people felt was not just due to burial rights alone. From a young age the children would be taught to interact with and learn from the natural world. It is from the natural environment that their crafts and skills would arise. The educational system of the ancient Hawaiians was know as *a`o*. Malcolm Nāea Chun in his summary of the Hawaiian system of knowledge transfer, *A`o: Educational Traditions*, describes the system as follows.

The *kumu*, or teacher, required a few important behaviors from the student. First the students were to "carefully observe" the patterns in nature such as ocean currents. Next, students were required "to listen and be attentive", this was important for memorization. Reflection was required next, before questioning. This was the act of "putting the experiences of observing and listening together." The student was then encouraged to put theory into action by "doing". Then finally the student would be allowed to "ask questions". It is expected that through these steps of observation, listening, reflecting, and doing that the student would have answered many of their questions themselves through critical thinking, thus student's questions were typically not answered until the process was complete.[96] This way of thinking is reflected in the chorus of the Hawaiian song "*Alu Like*".

[96] Malcolm Nāea Chun, *A`o: Educational Traditions* (USA: Curriculum Research and Development Group, 2006), 4-5.

II	II
E nānā aku i ke kumu	Let us look to the source (of our strength)
E hoʻolohe mai	Let us listen (to that source)
E paʻa ka waha	Let us work not so much with the mouth
E hana me ka lima	Let us work more with the hands

The educational system of *a`o* was also considered to be part of the social graces that would deem a person as *pono*. Along with the qualities mentioned above, Chun describes *pono* as "belonging, mastery of skills, independence and generosity."[97] These principles were and still are basic to human needs. By belonging they were offered mutual support from others in the village, through mastery of skills they were able to gain respect and able to offer something back to the community. It would follow that as one became more masterful in a skill and gained a stronger sense of belonging that they would become independent from their teacher and with this would begin the step of generosity. The generosity came after they gained independence from their teachers. they would them begin to share their knowledge, thus becoming the teacher themselves.[98]

The knowledge system in ancient Hawai`i was directly related to craftsmanship. The various labor divisions during the reign of Kamehameha I included "farmers, fishermen, canoe hewers, board hewers, paddle makers, calabash makers, and so on."[99] Kamehameha I was considered a great ruler for many reasons, one of which is the fact that he encouraged those who were most skilled in their craft to become teachers for the kingdom and thus become "the working arm of the government."[100]

The arrival of western worldviews began to change the face of traditional systems of knowledge. When the missionaries arrived they quickly began working on a written language for the Hawaiians using a phonics system. Literacy among Hawaiians

[97] Malcolm Nāea Chun, *Pono: The Way of Living,* (USA: Curriculum Research and Development Group, 2006), 2-7.
[98] Ibid., 6-7
[99] Samuel Manaiakalani Kamakau, Ruling Chiefs of Hawai`i (Revised Edition) (Honolulu, HI: Kamehameha Schools Press, 1992), 374.
[100] Ibid.

increased at lightning speed. It was of particular importance to the *ali`i* that the people learn to read, especially the leaders. Reading was seen as a source of power.

There was no separation of religion and education at this point in time. The first schools were set up on church grounds and the Bible was the curriculum of choice. By 1846 there were 80 books published in Hawaiian, and in 1839 the Bible was finally printed in its entirety in Hawaiian.[101] Schools were teaching lessons on Jehovah, as well as science, mathematics, astronomy, surveying and other sciences. The girls were also being taught lessons in good housekeeping.[102] This new type of school system that developed in Hawai`i put focus on subjects that were not necessarily relevant to living a sustainable life in Hawai`i and many of the crafts and craftsmen of the traditional knowledge system were lost due to the western style education.

By the mid 1800's there were 2 schools in the valley of Mānoa, one was Catholic and the other Protestant. The curriculum of reading, writing, arithmetic, geography and penmanship were still being taught in Hawaiian. Attendance to school was now required of all children from ages 4-14. The Caucasian children were being educated in their own private schools. The first English school in Mānoa Valley was established by legislature in 1864 and included in its curriculum counting, mental arithmetic, reading, maps, penmanship and punctuation. By 1886 legislature ruled that all instruction in schools should be in English.[103] The educational system proved to have huge effects on the culture of the indigenous people, whether helping to preserve it or drastically changing it.

WWI, along with increased industrialization, brought yet another population boom, and Mānoa was no exception. Mānoa School saw a student population increase to 352 students in 1926, compared to only 36 in 1910.[104] The electric trolley, replaced by the bus in 1933, kept extending its route into the valley. By 1932 there was an estimated 5000 residents in the valley occupying 1000 homes. This census was very revealing for the valley. There were now 800 Caucasian, 173 Japanese, 10 Chinese, and only 6

[101] Ibid., 405.
[102] Ibid.
[103] Manoa Valley Residents, *Manoa*, 153.
[104] Manoa Valley Residents, *Manoa,* 159.

Hawaiian residences listed in Mānoa.[105] Gone were the Hawaiians who had built a store of knowledge of this place through years of close interaction with the *`āina.*

Education was becoming a major priority for everyone during the 20th century and Mānoa Valley became a pentacle for educational institutions. The University of Hawai`i moved to the valley in 1911, having been established a few years earlier in 1907 as a College of Agriculture and Mechanical Art. Their campus in Mānoa started as a functional farm, remnants of which lasted until the 1950's. The private school of Mid-Pac found its home in the valley in 1906 not far from the steps of the already established private school of Punahou.

The Back of the Valley

Due to the educational goals of the ecovillage, the University of Hawai`i made a great candidate for the ecovillage design. The ideal physical location of an ecovillage for UH Mānoa would obviously be located in the valley of Mānoa. This would help to focus the research and energy of the students on the valley. This would allow the ecovillage projects to be focused on a local level. Seeing the many benefits of sustainable living demonstrated by the ecovillage would help to inspire other students and residents of the valley to live a more sustainable lifestyle. As the residents and students of Mānoa build the momentum needed to sustain their future they will become a beacon for other communities who are looking for inspiration to become more sustainable.

There are many ecological benefits to locating the ecovillage in Mānoa in close proximity to the campus. First, the students and faculty will spend less time driving between the ecovillage and campus to attend regular classes. The residents of the ecovillage will also benefit from sharing campus facilities, such as high tech laboratories or machine shops.

The location of the actual ecovillage within the valley of Mānoa was based on need and potential benefits. Not only will the ecovillage provide vast educational opportunities for the community, the projects based out of the ecovillage program will have many benefits to the surrounding physical environment. The back of Mānoa Valley,

[105] John Wesley Couler and Alfred Gomes Serrao, "Manoa Valley, Honolulu: A Study in Economic and Social Geography," *The Bulletin of the Geographical Society of Philadelphia* (April 1932): 109.

on and near the property of Paradise Park, was chosen because of its potential to teach, as well as its need to be cared for through conservation, preservation, and restoration.

The Lyon Arboretum has been working for decades to help restore the Mānoa watershed by planting trees (some more loved than others). Now the Lyon Arboretum works on preservation of their wide variety of plants as well as preservation of local culture through workshops for students and the public. The ecovillage will offer a complement to Lyon Arboretum and the various learning opportunities that they offer.

The biological community at the University of Hawai`i has great interest in preserving biodiversity by restoring the native flora and fauna in the back of the valley, where many invasive species such as the Albizia tree and Strawberry Guava have taken over. Not only does the site offer a chance for students to restore the native forest, it also offers the potential to restore the wetland behind the Paradise Park structure that was once home to a variety of fish and birds.

The valley also offers potential natural resources. It is important to understand where our resources come from so that we better understand their scarcity and the need to conserve. There are various potential resources in the valley that are helpful to human survival which could be cultivated and harvested in sustainable ways.

Figure 24. Satellite image of the back of Manoa Valley and the Paradise Park/Lyon Arboretum location
Source: www.google.com (accessed November 1, 2008)

The choice of the Paradise Park location for the ecovillage was also based on the fact that the land already has scar from previous development. There exists a main road, parking lots, structures, recreation trail, etc. (see fig. 24). The idea is to utilize what is already there and to expand on it in a way that incorporates strict ecological design strategies. The ecovillage development would then leave the site in a far more sustainable condition than that in which it was found.

Finding the right location for an ecovillage is primary to any good design strategy. The site needs to be one in which the mission of the ecovillage can be achieved. In the case of this ecovillage in Mānoa, in which education in sustainability is the mission, proximity to the University of Hawai`i at Mānoa made for an ideal location. Choosing the valley of Mānoa for the physical site was based on the proximity to the campus and the potential to share facilities. The fact that ecovillages tend to leave their sites in an improved ecological condition from that in which it was found, made the Paradise Park location ideal due to the various ecological needs of the valley. There is great potential for a mutually beneficial relationship between humans and nature to develop. This location also holds great cultural significance. The *ahupua`a* of Waikīkī, where this site is situated, has been part of the story of Hawai`i for centuries. The entire world holds affection for Hawai`i, and Waikīkī in particular, and will watch and learn as the ecovillage project begins to heal Mānoa Valley and the *ahupua`a* of Waikīkī.

Chapter 9: Programming Ecovillage Manoa

The Educational Program

The educational program is made up of graduate students whose theses are based on topics of sustainability. These students will apply for a highly competitive scholarship which will offer a room and board in a very unique community setting. There would be 30 students at any time from various degree disciplines including Agriculture Science, Architecture, Art, Business, Communications, Biology, Plant and Environmental Protection Sciences, Travel Industry Management, Social Work, Meteorology, Engineering, Hawaiian Studies, Family Resources, Dance/Theater, Music, American Studies, Global Environmental Science, Leisure Studies, Geology, History, Philosophy, Religion, Anthropology, Economics, Geography, Political Science, Sociology, Natural Resources and Environmental Management, Microbiology, Botany, Tropical Plants and Soil Science, and Education. These students will be directed by a committee that they assemble which includes one of the 3 permanent faculty members that live in the ecovillage full time.

Besides their graduate research, focused on sustainability, their studies will also include various smaller group projects that are focused on the ecovillage site. These could be unique student designed projects or assignments from the resident faculty. Along with the community based projects, participants will also be expected to participate in maintenance, shared cooking and meals, gardening and any other issues of maintaining the community that may arise. Much of the student living will take place in the community center which will house laundry, kitchen/dining, offices, shower/bathrooms, meeting spaces and a guest room.

There is a need for classroom spaces, both indoor and outdoor, for the residential graduate students, visiting primary and secondary school students, and the public. The visiting students and public will be encouraged to participate in the community meals. The food for the community will be provided from the land and will be grown organically through the restoration of traditional poly-culture and aquaculture. Chicken, fish, and wild boar will be served from the land as well. The restaurant will be converted

to all organic locally grown food and profits will go to fund the ecovillage education projects.

The site and buildings will be designed in accordance with strict ecological design strategies. The ecovillage will be responsible for its own water and sewer as well as renewable energy sources. The amenities will be simple. There is to be no air conditioning unless the space specifically calls for it, such as a library. The site will be disturbed as little as possible by humans. The goal is conservation and restoration of the native Hawaiian forest, preservation of the watershed, and restoration of the wetlands while at the same time providing educational and recreational opportunities.

This village will attract distinguished visitors from around the world who must also be provided a place to live both long term and short term. There could be up to 7 guests at one time. Guests will be required to participate with the community in regular cooking duties, maintenance, and gardening and will be encouraged to interact in social activities as well.

There will be a focus on self-realization. Spaces will be provided for meditation and times set aside for deep reflection, while other spaces will be provided to encourage group participation, allowing for reflection on how others affect our spiritual growth.

This unique educational experience requires a unique program that effectively incorporates the human built environment into the natural ecosystem. Each space will offer an opportunity for learning and teaching of an ecological consciousness, whether through the simple design and materiality, or through the expertise of the guests who are provided rooms in each housing group. Creating spaces for this group of students, faculty, and guests, who are of diverse backgrounds and disciplines, to share their concepts on sustainability will allow for greater understanding of the various interests involved and the complex networking required for these concepts to become a reality.

The Physical Program

Programming of Ecovillage Mānoa includes interior and exterior spaces. Both play a huge role in the function of this ecovillage. There is a need for educational spaces, community spaces, and personal residential spaces. There is also a need for land divisions and uses that include conservation, preservation and restoration. Land use

patterns and existing structures were major considerations in the programming of the ecovillage spaces. The program list includes general estimates for the number and size of these spaces. This list helped to inform the design by making it clear which spaces could be provided by the existing structures and which spaces would need to be built (See table 1). In this case the most lacking element was residential structures, therefore they were the main focus of the design project.

Table 1. Program of physical space requirements of Ecovillage Mānoa

Ecovillage Program for Mānoa	**# of Spaces**		**Sq ft. per space**	**Total Sq. ft.**
30 student Residents, 3 Resident Faculty, 17 Lyon Staff				
Barn/warehouse/storage	1		1000	1000
Bathhouse	1		400	400
Bookstore	1		300	300
Classroom spaces- UH, charter high school	5		750	3750
Workshops- art, wood, metal,	3		750	2250
Laboratory	2		750	1500
Studio spaces	30		50	1500
Common house				
Kitchen	1		800	800
Laundry	1		200	200
Dining (for 50)	1		750	750
Mail	1		30	30
Living (for 50)	1		1000	1000
Round Meeting Room			1000	0
Entertainment- dance, music, theater, presentations	2		2000	4000
Offices	20		70	1400
Housing - perm faculty	3		1200	3600
Housing - semi-perm student	30		500	15000
Housing - visitor (B&B, camping)	10		300	3000
Hunting stations	5		200	1000
Infirmary	1		300	300
Library	1		600	600
main plaza (100 people)	1		1500	1500
Meeting rooms	3		150	450
Reception area- For Lyon, for Ecovillage	2		200	400
Restaurant-dining and kit	1		1500	1500
Shade/green houses	4		500	2000
spiritual spaces-interior and exterior (meditation)	3		20	60
Store-general	1		600	600
Tool Shed	1		400	400
TOTAL:				49,290

Existing				
Lyon Cottages A-H; 2 residents, one guest house, offices, reception,	1	12600		
book store, educational outreach center, plant laboratory				
Lyon Green/shade houses	1	1300		
Paradise Park building; kitchen, dining, office space	1	30666		
TOTAL:		44,566	sf	

Chapter 10: Land Usage and Master Planning

When designing any type of campus it imperative to have a good master plan. Although it is important to be flexible in design, master plans help to give direction to a project and help in avoiding many costly mistakes throughout the life of the project. The master plan for the ecovillage in Mānoa was created keeping a few major elements in mind. Basic site analysis revealed the patterns of nature and humans such as traffic flow, parking, existing structures, property lines, water routes, topography, soil types, land usage, and the path of the sun and wind. A thorough analysis of the site helped to determine the placement of the various new structures that would be needed for the ecovillage as well as appropriate usage of existing spaces.

As stated previously, one of the major reasons for choosing the site of Paradise Park for the location of the ecovillage was the fact that there was already previous development of the site. This development included a two lane road cutting through the site that leads to Lyon Arboretum and Mānoa Falls trail head. Utilizing this existing road will help to minimize the intense ecological impacts that come with cutting in new roads. Also found along this existing road are two very large parking lots that were created to accommodate the large tour buses that once frequented Paradise Park. This has the same ecological benefit as the previously cut roadway in that no new parking lot will have to be cut into the already fragile ecosystem

Figure 25. (left) Example of existing cottages at Lyon Arboretum

Figure 26. (right) Existing greenhouse at Lyon Arboretum

Figure 27. Existing Paradise Park building

Not only are roads and parking already existing at the site, the site also has various structures that are only partially utilized. Many of these structures are actually part of the Lyon Arboretum site, above Paradise Park (see figs. 25 and 26). Because Lyon Arboretum is seen as a major player and benefactor of the ecovillage, these structures were included as part of the study on required spaces. The largest and potentially most functional existing structure on the site is the Paradise Park building. (see fig. 27). Currently it is only used for a few office spaces and a restaurant that occupies the upper most floor. The building contains 30,000 square foot that would be converted to classrooms, meeting spaces, laboratories, workshops, offices, theater, organic/local food restaurant, and library. This building will be retrofitted for passive/solar design, which will include allowing for natural ventilation throughout, proper day lighting and shading, as well as solar and wind power. The building's rainwater will be harvested from the roof for reuse throughout the building and for irrigation of the surrounding gardens. Waste water, both grey and black, will be diverted to the "Living Machine" that will be located between the existing structure and the new Common House. Reusing the existing building not only saves the building materials that

would have been required for a new structure, but also avoids burdening the landfill with construction demolition materials.

When looking at other patterns created by humans and nature, water played a far greater role in the master planning of the ecovillage than did property lines. The majority of properties that are not leased by Paradise Park are owned by the City and County of Honolulu (see fig. 28). For the purposes of this academic exercise it was assumed that the City and County would be more than willing to lease off parcels of their properties in the valley for the use of the ecovillage. When the property lines disappear from the map, the water and topography are better able to define the master plan.

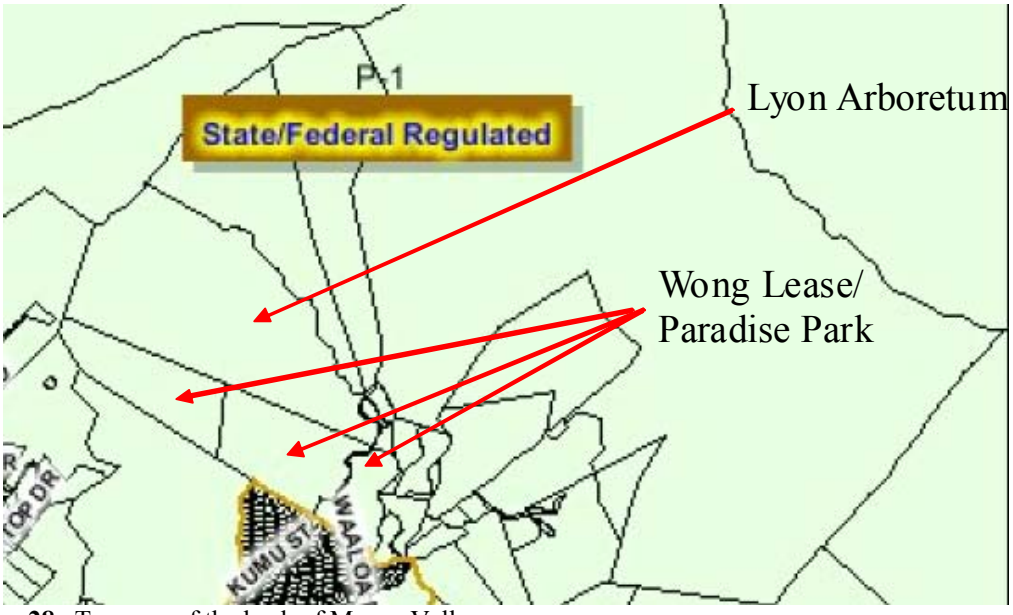

Figure 28. Tax map of the back of Manoa Valley
Source: Honolulu GIS

There are various streams that make their way down to the land behind the Paradise Park building. This particular area is a lowland area in which water ponds before moving down the valley in the Mānoa Stream. It is in this natural low area, where Paradise Park once had ponds with fish and birds, that the wetland will be restored. The ponds formed in this area will be part of the restoration of traditional aquaculture that once provided fresh water fish protein to the indigenous peoples of the land. The ponds will not only offer food and habitat, they will also offer a place of quiet reflection for residents and visitors alike (see fig. 29).

Aquaculture was only one traditional use of the water and land. Polyculture was also practiced using both wet and dry terraced gardens. These wet and dry gardens will also be restored on the site. These gardens will not only provide nutrition for the residents, they will help preserve the indigenous culture by reviving an intimate knowledge of food production in the islands.

It was near the beginning of the 20th century that the movement to protect the environment took two very different directions. One was a very human centered point of view which called for the conservation of nature, to protect it as a resource for human consumption. Of particular interest to this group were the waterways, and their potential to generate a great deal of hydro-electric power for the growing American demands.[106]

The other school of thought was that of the preservationists, who took more of a bio-centric approach to the preservation of the natural environment recognizing its inherent value as well as its recreational, educational and spiritual value to humans.[107] The conservationist won out with the support of President Roosevelt in 1908 when the preservationists such as Muir were not invited to the International Conference on Conservation. In the hands of the conservationists the land was once again at the mercy of human needs and desires. The need for conservation later became very obvious with the Dust Bowl, lasting from 1930-1940, which warned the world that the loss of ecological consciousness has devastating effects on the natural environment.

Part of the land use division of the Mānoa Ecovillage site includes conservation, preservation, and restoration land. Conservation implies that the land has potential resources that would be helpful for human survival, but that they need to be protected and harvested in a way that would sustain that resource into the future. Currently, the forest designated by the ecovillage as conservation includes a large stand of bamboo located on land of City and County planted to preserve the watershed and prevent erosion. This stand of bamboo is seen as a great resource for the ecovillage since bamboo is the fastest growing renewable resource on the planet. Converting some of the bamboo stand to structural grade increases the potential of this resource for the ecovillage, the valley, and the island of O`ahu (see fig. 30).

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[106] McCormick, *The Global Environmental Movement*, 14.
[107] McCormick, *The Global Environmental Movement*, 15.

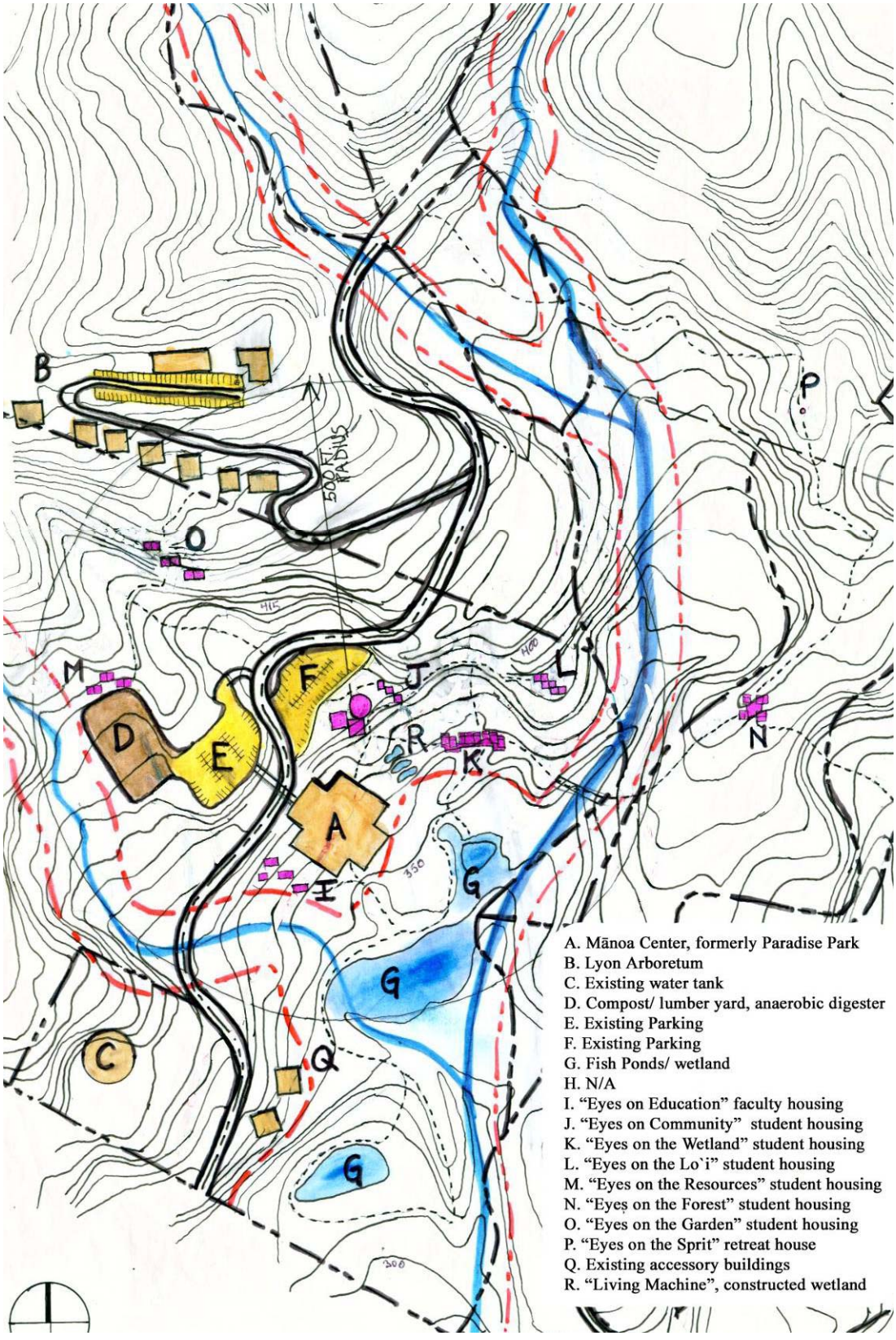


Figure 29. Site Plan for Ecovillage Manoa

Figure 30. Land Use map of Ecovillage Manoa

Located in the native forest restoration areas of the valley are the highly invasive Albizia tress. These are fast growing trees from the South Pacific that did very well in the valley of Mānoa where they were planted to try to repair damage done to the watershed by improperly tended cattle. In order to begin to restore the ecosystem in the valley these trees need to come out. As these grand trees are "weeded" out of the forest, their lumber will be put to use in the construction of the ecovillage.

In order to better process the valuable resources that the valley offers, the ecovillage master plan includes a lumber and compost yard near the existing parking (see fig. 29). It will be here that the trees and bamboo will be cleaned, dried, and formed into useful raw material that can later be crafted into various useful materials for building and living. This compost/lumber yard will also include ancillary buildings for storing equipment and tools. Other storage buildings and barns will be constructed near the gardens as well.

The location of the student and faculty housing units is unique to this ecovillage design. The people who took care of the land in traditional Hawaiian society were known as the *maka`āinana*. This translates into "eyes of the land" or "eyes on that which feeds us". The ecovillage housing units are distributed throughout the site in a way that offers a greater chance that someone will be keeping an eye on the health of that part of the land. The various distinctions are "Eyes on the Lo`i", "Eyes on the Garden", "Eyes on the Forest", "Eyes on Education", "Eyes on the Resources", "Eyes on Community", "Eyes on the Wetland". (see fig. 29).

The master planning of the ecovillage in Mānoa focuses on utilizing the site to the greatest benefit to the ecosystem. The ecological damage caused by cutting new roads and parking is minimalized by using those that already exist. Watching the patterns in nature, like the flow of water and topography as well as soil types, helped find balanced locations for gardens, fishponds, and people. Recognition that the valley has natural resources to offer led to the creation of a lumber/compost yard to process these resources. Local, recycled and rapidly renewable resources have less embodied energy because they do not have to travel great distances and they offer options to less sustainable resources that come from strip mining or harvesting of old growth forests.

Analysis of the various human and natural patterns on the site also led to the location of the student and faculty housing units. These units are spread about the site on south facing slopes providing adequate light and shade. They are provided with views to various areas of the land and community, such as the forest, the wetland, as well as the classrooms so that even when sitting in ones private space one is still offered the opportunity to learn from the site through observation.

Chapter 11: Energy

Hawai`i offers many opportunities to take advantage of alternative and renewable energy sources. Mānoa Valley is windy and rainy during parts of the year and sunny and hot during other parts of the year. This makes the site a good candidate for wind power as well as solar electric and solar thermal. Hot water for showers and the kitchens will be provided by rooftop solar panels, while electricity will be provided through on-site renewable energy. The units that are near the power lines will take advantage of the grid, using it as the storage device, eliminating the need for batteries to store the electricity from the sun and wind (see appendix A and B).

Some units are better situated to take advantage of the sun, others the wind, while others will need a hybrid systems that takes advantage of wind part of the year and the sun the other part of the year. The "Eyes on the Wetland" units which are located out away from the valley walls offer lots of solar exposure. The units have large amounts of south facing rooftop with few trees around making it the ideal location in the village for a solar array. The "Eyes on the Forest" units are located among the trees up on the sloping sides of the valley walls. This location makes these units less likely to benefit from solar energy, but does offer a good opportunity for the collection of wind energy (see appendix C).

Another opportunity for on-site energy production comes from the vegetation itself. The valley has become much like a rainforest and vegetation grows to prehistoric sizes with great speed. There will be a constant need to cut back the jungle like growth from the various structure and gardens, as well as from the conservation and preservation lands, which includes vast amounts of Albizia trees that need to be thinned out of the forest. This green-waste will be used to create valuable compost that will be returned to the forest and gardens. During this process of decomposition this organic material off-gasses a methane that can be captured and used as a bio-fuel. This bio-fuel will be used onsite for various purposes including the creation of electricity.

The use of local renewable energy has all the benefits associated with reducing fossil fuel consumption. Fossil fuels, especially coal, add significantly to air pollution and global climate change, not to mention the political tension created through our

dependence on the oil that comes from the Middle East. Hawai`i is particularly remote and any fossil fuels that come to the island must come on ships that run on fossil fuels as well. The use of on-site renewable wind, solar and biomass power also takes pressure off the Hawaiian Electric Company to build another power plant in order to keep up with the increasing electricity demands.

Chapter 12: Water

Figure 31. Manoa Falls

When designing with nature, water should be the first natural force to be considered on any site due to its shear power and ability to shape the landscape. Like the land and people of a place, the history of the water holds much invaluable design information about a place.

The peaks and cinder cones of Mānoa valley were created over 2 million years ago by molten lava and fiery ash.[108] Even before humans came, the waters of Mānoa stream were being pushed and pulled by the flow of lava through the valley and emerging cinder cones, finally leaving it on the eastern side of the valley. The high peaks of the valley are part of the Ko`olau Mountain range. They reach up to catch the rain clouds

[108] Sonia P. Juvik and James O. Juvik, ed., *Atlas of Hawai`i, Third Edition* (Honolulu: University of Hawai`i Press, 1998), 38.

and squeeze them dry onto the hills within the valley of Mānoa. This water, abundant of up to 160 inches per year at its highest elevations, formed several notable waterfalls (see fig. 31). From these waterfalls the rains found their way to the ocean through creeks and streams which eroded the lava rock into a variety of smaller steep valleys and sharp mountain ridges. The water also flowed through the earth into caves and underground rivulets that would push the fresh cool water up and out into the light in the form of fresh water springs. And slowly, over thousands of years the valley became more and more inhabitable. Native trees such as Koa and ferns like *palapala`ai* took hold along with other native plants and were greeted daily by dozens of species of birds that graced the island before humans arrived in the valley. A culture of plants and animals, land and water, winds and rains developed as the vent moved away from the valley.

Only the islands themselves know the exact day the first humans arrived, walking on their two legs, hungry for food and thirsty for fresh waters. Some scholars say they arrived between 0-350 CE, although Mānoa was believed to have been permanently settled much later. So appealing were the fresh water and springs of Mānoa to the Hawaiian settlers that only a power much greater than their own could have created them. This great force that had created these springs was *Kāne*, the god of fresh water. *Kāne* and *Kanaloa*, another major god of the Hawaiians, made their home at the highest peak of the Ko`olau mountains, *Konahuanui*. They would spend their days fishing in the waters by Kahala. One day after fishing and wading in the salt water for their nets, the gods desired a fresh water bath to rinse the salt from their bodies. *Kāne*, being the god of fresh water, was teased by *Kanaloa* about there being no fresh water around. So he had *Kanaloa* follow him to the mouth of Mānoa Valley, where *Kāne* struck the ground with his *o`o*, digging stick, and brought forth fresh water from the earth. This spring was named *Kānewai*, or waters of *Kāne*. The journey of *Kāne* and *Kanaloa* through the valley of Mānoa brought forth many more springs of water. These springs were named *Hualani, Wailele, Punahou, Ka`aipū and Wa`aloa*. These waters would be revered for centuries by the Hawaiian *ali`i* and commoners alike for their sweet and healing waters, now full of Leptospirosis.

By the late 19th century there were 2 profitable dairies in the valley. One of which, the Woodlawn Dairy, went from 10 cows in 1879 to 700 in 1890. Cows have a

dominating effect on ecosystems in general if not tended to properly, and this was the case in Mānoa. Trees in the valley were being cut down to create pasture land, and the cows compacted the soil, caused erosion, and ate the tree saplings. The damage done by the cattle to the land and watershed combined with increased water demand from the city of Honolulu caused the aquifer to be drained quicker than it could be recharged. This damage to the land from cattle would not be fully dealt with for another 30 years when the watershed began to be protected at the site of the Lyon Arboretum.

During the 20th century, the waters of Mānoa were being diverted to the city to support the ever increasing population. The Ala Wai canal was built, making the once fertile wetlands available for housing. Eventually, while piles were being drilled for a foundation at the base of the valley a hole was punctured in the water table, causing much of the fresh surface water in Mānoa to retreat back underground. This was all in good time for more housing, and an end to agriculture in the valley.

If there is one theme that runs through the whole history of this valley it would have to be water. What made this valley so attractive in the first place was its abundant fresh water. This water was used for centuries for agriculture in the valley, but also flowed into the marshy lands at the bottom of the valley as well, where it was filtered before it met the ocean. Now that the land has been hidden away by rooftops, sidewalks, driveways and streets, the water no longer affords a beneficial relationship with the land. In fact it is as if the water is despised, something to be hidden away in pipes and removed as quickly from this place as possible. The water once lingered on the land and meandered down curving streams, seeping back into the ground to recharge the aquifer, evaporating and transpiring to continue the hydrological cycle. Concrete now lines the stream to prevent the water from doing what it had always done, soak the land. This type of system that ignores the patterns of nature, especially when it comes to water, often creates devastating effects. Forty days of rain in 2006 caused the sewer systems to be inundated with storm water. This caused the city to make a decision to release 48 million gallons of raw sewage into the Ala Wai canal which empties directly into the ocean by the beaches of Waikīkī. The beaches were closed for a couple of weeks, but some locals, who were there to see the Ala Wai turn red with pollution, did not enter the ocean at Waikīkī for another 6 months.

Because water has played such an important role in the history of Mānoa Valley and Hawai`i, it is a major focus in the design of the ecovillage. There is an average rainfall in the back of the valley of 120 in/year. This huge amount of water makes its way to the ocean quite rapidly via Mānoa Stream. In order to protect the coral reef and to recharge the aquifer it is important that any and all strategies to deal with rainwater runoff be implemented into the design of the ecovillage.

Rainwater will be harvested from the rooftops and reused within the buildings, in the gardens for irrigation and for replenishing of the fish ponds. The fishponds and lo`i will allow for the natural retention of rainwater while at the same time providing food for the residents in the form of fish, rice and taro. They will be a source of recreation as well. This retained rainwater will return to the hydrological cycle before ever making it downstream. Returning storm water to the aquifer and keeping polluted runoff out of the streams will also be achieved through the use of permeable pavers in roadways and parking lots, as well as with bio-swales along roadways and parking that act as a second barrier to catch pollutants.

The aquifers in Hawai`i are particularly important to the fresh water supply. Not only will the aquifer be recharged through the methods mentioned above, water conservation strategies will also be incorporated throughout the ecovillage. Water conservation in the ecovillage will be achieved using various methods including low-flow fixtures, xeriscaping, and composting toilets. Another benefit of water conservation is that the less water used, the less that has to be treated. Sending waster water to city sewers often puts a huge strain on local municipalities to store and treat it. The waste water that does result in the ecovillage after using the various conservation methods will be treated using grey water filtration systems as well as the “Living Machine” for the black wastewater. Both of these options offer on-site treatment of water and the return of it to the site as well as the return of the by-products to the garden and forest in the form of compost (see appendix F).

Fresh water is a precious resource, and a limited one. Fresh water not only offers physical life, it holds great cultural and spiritual significance. The use of water conservation design strategies at the ecovillage site will reduce demand on the aquifer, while water retention and on-site wastewater treatment methods will help to recharge the

aquifer, guaranteeing fresh water into the future. Water retention through on-site ponds, cisterns, and permeable surfaces will reduce storm water runoff from the site reducing the pressure on the city sewer system, as well as pollution levels in Mānoa Stream, the Ala Wai and at the beaches of Waikīkī (see appendix D).

Chapter 13: Grids, Modules and Materiality

Due to the fact that the housing for this particular ecovillage is for students and visiting scholars, the individual bedroom are all the same size and therefore well suited for a modular system based on a grid. This system was applied to each of the various housing groups (see fig. 32). Not only was the floor plan based on a modular grid. The building skin is based on a modular system of salvaged materials. Not only is the materiality of the units based savaged materials, other resources available in the valley, such as bamboo and Albizia, are taken into account.

Although modularity seems to insinuate a lack of variety, the opposite is actually true. Take for example the wide variety of life on Earth, all created from the same basic building blocks. We are all interconnected and made up of the same stuff.

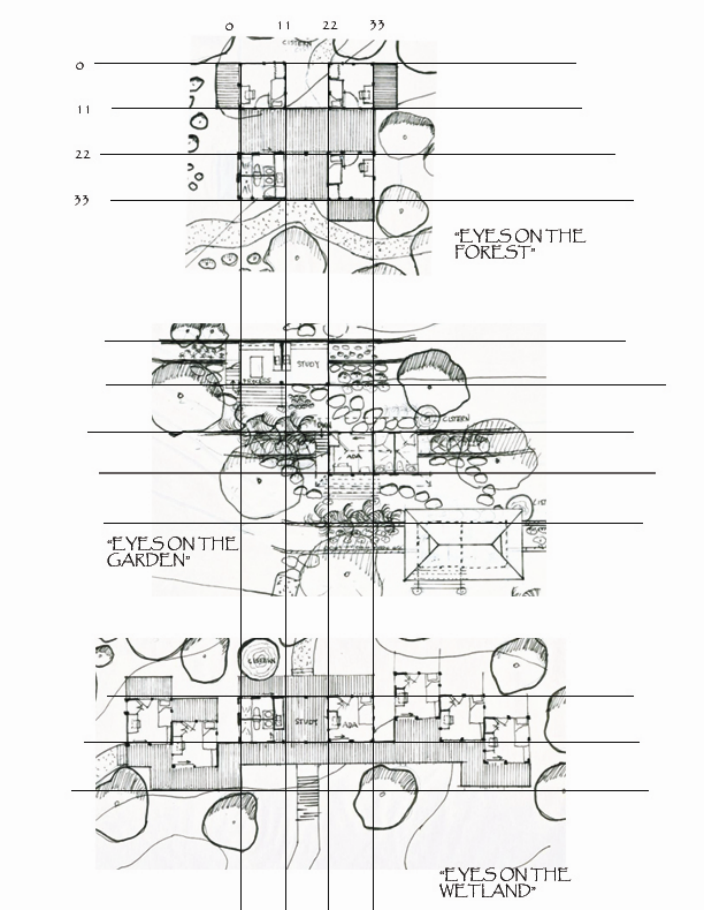


Figure 32. Grid system for ecovillage housing

Modular systems offer sustainability in their efficiency of production, but in this

case, trying to be sustainable on a Home Depot grid system did not seem to make sense due to the fact that all the 4x8 modular products available at the hardware store are shipped to the islands. There are few options in Hawai`i when it comes to local resources, especially those that are rapidly renewable. What there is plenty of, which is evident in the local neighborhoods once a month, is a profound amount of bulk waste. This bulk waste ranges from baby carriages to building materials. The use of salvaged materials on the island has great potential. There are places like Craig's List, Habitat Restore, and Nanikuli Baseyard where used building materials can be purchased at a discount. There are various modules that could be created using the most abundant materials found from these sources, such as windows and doors.

Not only is there a great deal of bulk waste on O`ahu, there is also a great deal of construction waste from buildings trucked to the landfill. There is an opportunity here to base new designs on the availability of deconstructed building materials. Punahou School, located in Mānoa Valley, has major renovations planned for their campus, which includes the demolition of the elementary school, know as the Winne Units (see figs. 33 and 34). Not only do the Winne Units hold great *mana*, or life force, from the hundreds of children that spent their days there, they were also designed by the renowned architect of Hawai'i, Vladimir Ossipoff. This offers an opportunity to hold onto a piece of history and the stories of another time.

Upon a quick measure of the Winne units it was discovered that they contained almost the exact amount of wall space that would be required of all 40 sleeping units of the ecovillage. Therefore, the module system for the skin, and some of the structural systems was based on the salvageable materials from the Winne units. The Winne Units offer fixed glass windows, solid doors, large glass sliding doors, clear glass jalousies, opaque jalousies, as well as large and small I-beams (see fig. 35).

Figure 33. Winne Units at Punahou School showing louvered windows, large sliding doors and copper gutters that could be reused

Figure 34. Winne Units at Punahou School showing fixed glass windows as well as covered walkway materials that could be reused

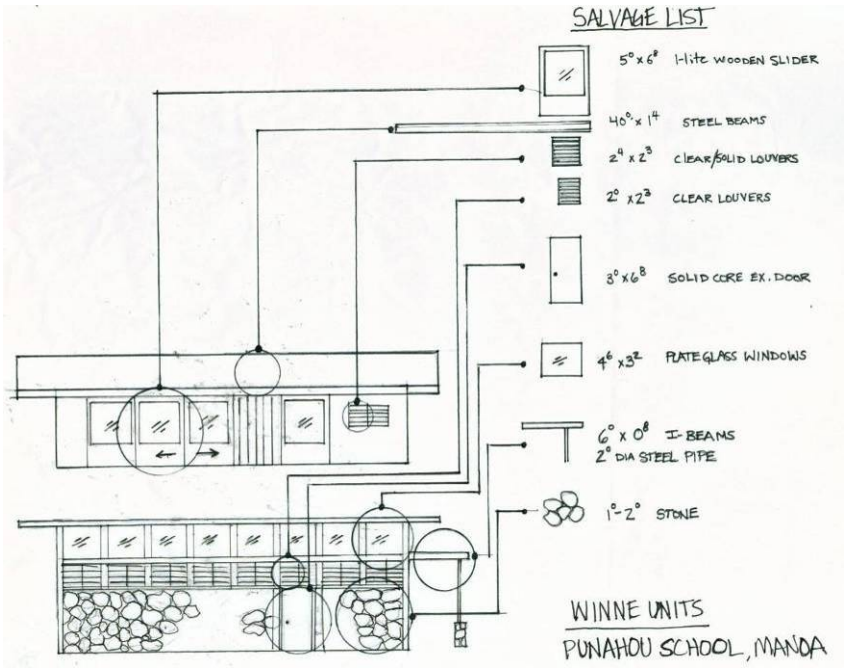


Figure 35. Diagram of materials to be salvaged from the Winne Units

The materials that are not provided by the Winne Units will be mostly those used for the structure as well as the interiors and systems, such as electrical and plumbing. According to the College of Tropical Agriculture and UH, the lumber from the invasive Albizia tree is known to be used for finished flooring, cabinets, light frame construction, light weight veneer and plywood, and low density particleboard. Those trees that are cut out of the forest will be used to their fullest potential in the construction of the ecovillage (see figs. 36 and 37). Bamboo, also found in the valley of Mānoa, has endless possibilities in the construction and interior finishing of the ecovillage units.

Although each of the ecovillage housing groups have a unique design based on their focus, they all share in common the very basic building blocks. They share a common grid system that will make for easy construction and less construction waste. The designs of the ecovillage structures, based on salvaged building materials, bamboo, and Albizia, have many ecological benefits. Using salvaged materials from the Winne Units will keep these materials out of the landfill, reducing the need for creating new landfills or worse, shipping waste off the island for others to deal with somewhere else. Reuse of building materials will reduce the demand for the natural resources and energy needed to create new building materials. Rapidly renewable resources, such as bamboo, generally require far less time and energy to produce, putting less burden on the natural

environment, not to mention that there use can reduce the demand for virgin materials such as old growth forests and items that must be mined. Although Albizia is not a rapidly renewable resource like bamboo, it is a local resource that can be put to a very functional use, reducing the fossil fuel needed to ship in raw materials from elsewhere. The benefits of using the Albizia are multiple. Removal of this invasive tree from the valley is imperative to the restoration of the native forest, but leaves a very large carbon footprint as trees release carbon as they decay. Using the wood from the trees for building materials stores the carbon, keeping it out of the atmosphere.

Figure 36. Albizia tree being cut down at Lyon Arboretum

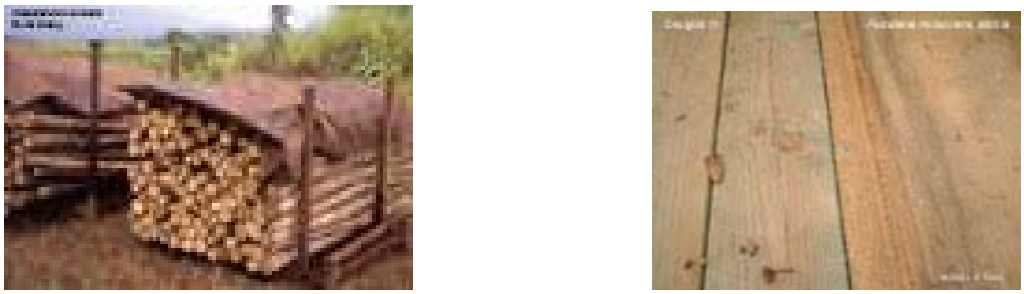


Figure 37. Albizia wood construction materials: *right* flooring; *left* lumber
Source: http://www2.ctahr.hawaii.edu/forestry/trees/Falcataria_Khaya.html (accessed April 22, 2009)

Chapter 14: "Eyes on the Land"

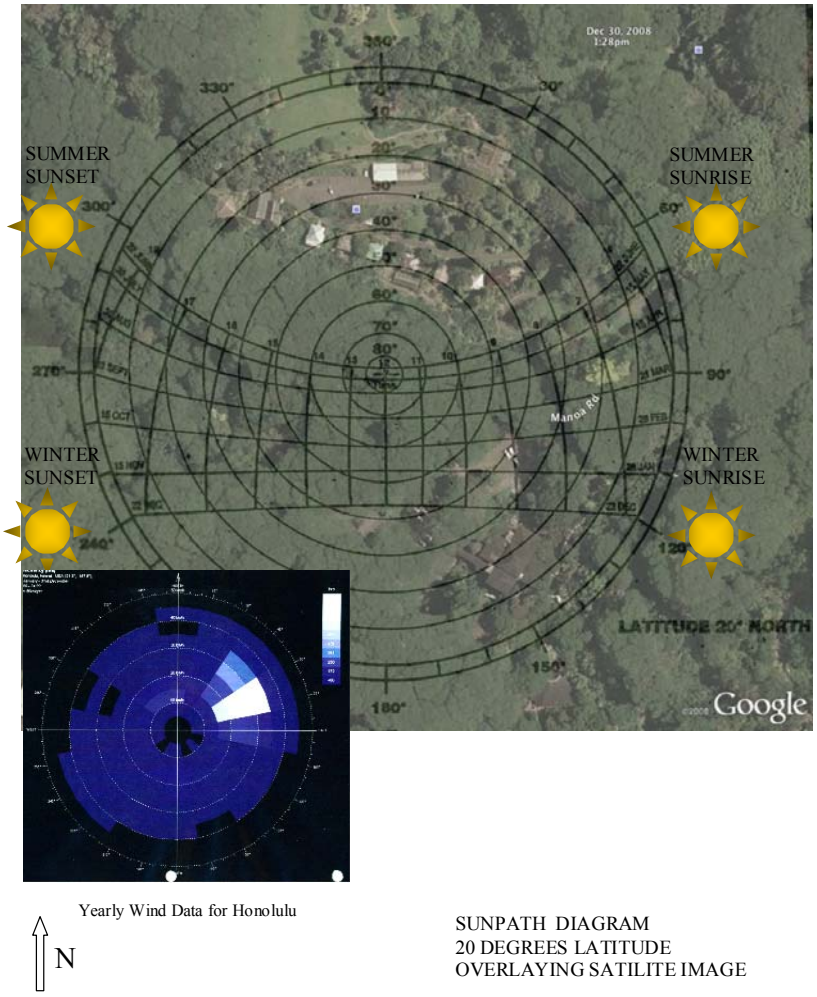
One of the greatest benefits of living in community is the ability to share with others. The choice to locate the housing groups in different vantage points allows for a diversity of opportunities for sharing. Each group offers the others what is unique to their location and to the design of their structure and landscape. Some groups are in the position to harvest water for the use of the gardens and in the buildings, others are better located to provide power for the village through solar panels or wind turbines. The other unique opportunity offered by the placement of the villagers across the land is that of taking care of the land. The units are located in distinct areas where they will become part of the process of *malama `āina*, such as restoration of the native forest or conservation of resources. This type of diversity on the site also allows for greater educational opportunities. The graduate students will be in a rotation during their stay, and will be able to experience the various spiritual, social and physical aspects of each of the housing groups.

Each of the housing groups consists of 6 sleeping units at 120 sf each, shared study/living area w/kitchenette and two full baths. Outdoor spaces and shared spaces are utilized throughout the design for a smaller footprint. All the various housing groups bedrooms are based on the 11ft grid. All the groups have a shared living, kitchenette and bathrooms and have been designed to promote a simple lifestyle. The furnishings are of locally harvested bamboo and the rooms have a single bed, a small desk, bookshelves and one small closet.

All the housing units have been designed keeping in mind a whole systems approach. The location, shape, size and materiality of the units are all dependant on how the space is to perform. The housing units are all located on south facing slopes to take advantage of natural daylighting as well as sun shading. The majority of windows are on the north and south sides of the units to avoid the low rays of the morning and evening sun. The units are also designed to take advantage of the trade winds that are predominantly from the East-Northeast (see figs. 38-41). Each room is thin to allow light to reflect deep into the room from the south and there are openings on at least two

opposite walls to guarantee cross ventilation of the space. Each unit is also designed keeping views and perspective in mind, while allowing for privacy when necessary.

The position and style of the roofs were determined based on the type of on-site renewable energy is to be used. For example, units which are to take advantage of solar electric and solar thermal energy need to have adequate south facing rooftops with a slope matching or within 15 degrees of the latitude of Hawai`i of 21 degrees north. The size and materiality of the roofs also plays a large part in the ability to harvest rainwater. Metal roofing is the material of choice for rainwater catchment in order to avoid the debris and chemicals often associated with other roofing material options. Extending roof overhangs and providing covered walkways also offers more surface area for rainwater catchment.



Yearly Wind Data for Honolulu

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SUNPATH DIAGRAM
20 DEGREES LATITUDE
OVERLAYING SATILITE IMAGE

Figure 38. Wind and sun path data for Mānoa

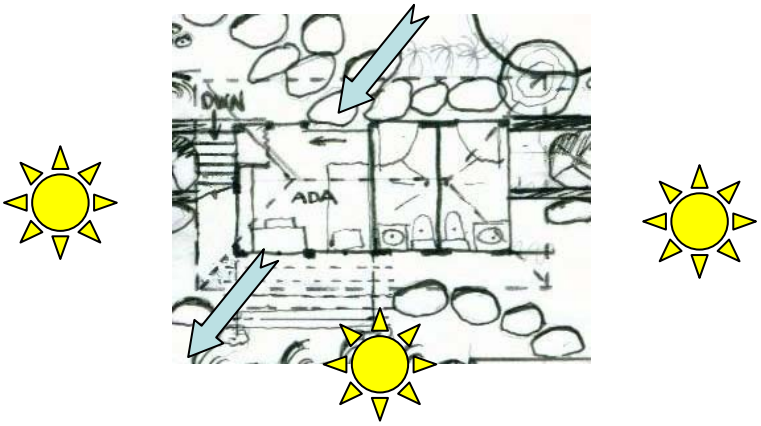

Figure 39. "Eyes on the Garden" room layout, sun path and trade winds

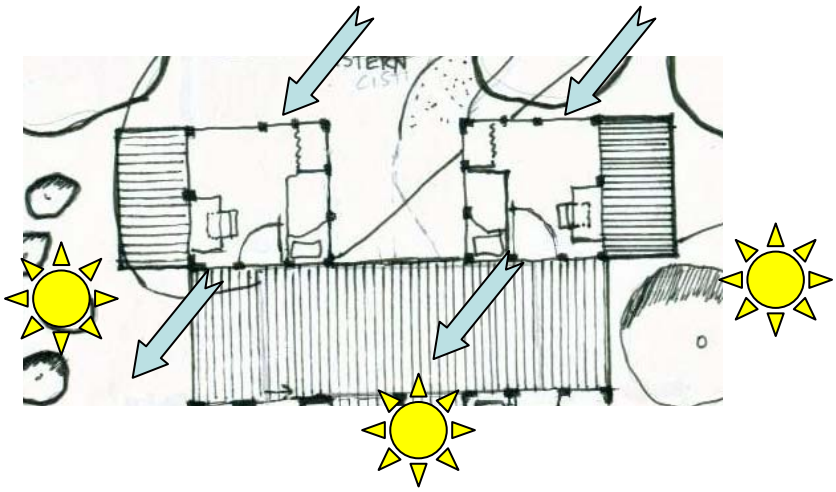

Figure 40. "Eyes on the Forest" room layout, sun path and trade winds

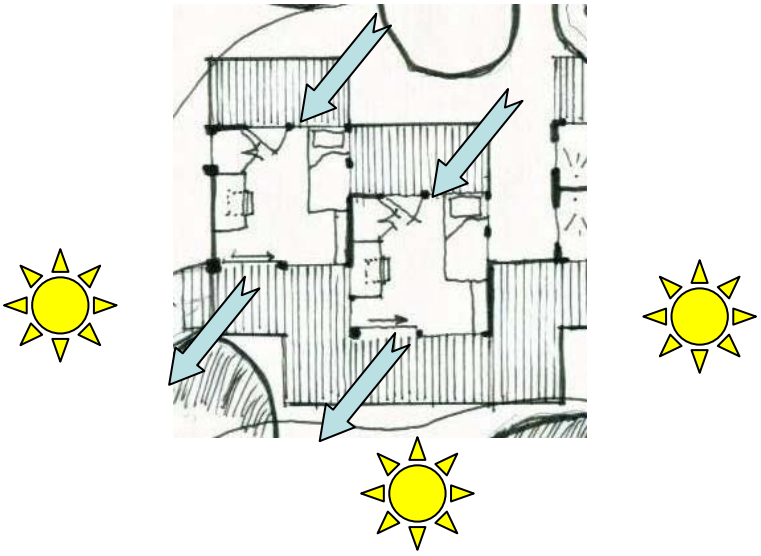

Figure 41. "Eyes on the Wetland" room layout, sun path and trade winds

The “Eyes on Education” group is the Faculty housing group. They are near the Mānoa Center, formerly Paradise Park, as well as the Common House in order to better care for the needs of guests, visitors, and students who have come for an educational experience.

The “Eyes on the Lo`i” group is located above and in the midst of the *lo`i* in order to allow students proximity to work in these water gardens and to participate in their operation. These units will help the student recognize the intimate relationship between humans and nature that is required for the land to be fruitful.

The “Eyes on the Resources” group is located above the compost/lumber yard in order to keep an eye on the harvesting, processing and use of the valley’s renewable resources. Spending time in this space will help the students become aware of and evaluate human needs versus a sustainable existence.

The “Eyes on the Spirit” retreat offers a place for personal solitude and an intimate connection to the spirit of the valley. This space offers the peace and quiet for the meditation and self-reflection necessary on the path to self-realization.

The “Eyes on Community” units will be located near the Common House in order to allow them to better observe and work on projects related to the culture of the village. They will be in charge of projects related to rituals and celebrations as well as group dynamics.

The Common House is a shared space for the residents and guests of the eco-village. This 2000 sf facility will be located on existing disturbed area. It will be comprised of the community kitchen and dining area as well as the living room. There will also be a large round inspirational meeting room for members of the ecovillage to have group meetings. This building will also be home to the laundry facilities, a mail room, and an infirmary. This community space will offer the opportunity to build relationships with others. Mutual support and sharing, consensus building, and group work within these spaces will help to create more social capital.

"Eyes on the Forest"

The "Eyes on the Forest" units are located up near the edge of the forest at the back of the valley (see figs. 29 and 42). Here the units have been designed to take advantage of views into the various levels of the forest. Students will be elevated to the upper canopy, as well as grounded near the roots and trunks of the trees. (see fig. 43). The structure is on a foundation of piers to leave the forest floor as untouched as possible.

The main function of the residents of these units is to protect, preserve and restore the native forest of the valley. Their vantage point not only allows them to keep an eye on the various regions of the valley, they are also in a position to act as a tree nursery. From their position they will act as a heart center for native tree distribution in the valley. Slowly, from their site, the residents of these units will replant the forest with native trees (see fig. 44).

Restoration of the native forest has many ecological, cultural and spiritual benefits. Replanting of native trees would encourage the return of other native flora and fauna to the valley, preserving and increasing biodiversity which is imperative to the health of the environment, while at the same time offering educational opportunities in this outdoor laboratory (see fig. 45). Return of the native flora and fauna will also help restore the place based knowledge of ancient Hawaiians. Planting of trees in the valley has played and will continue to play a huge role in the restoration of the watershed through the prevention of erosion and the resulting recharging the aquifer.

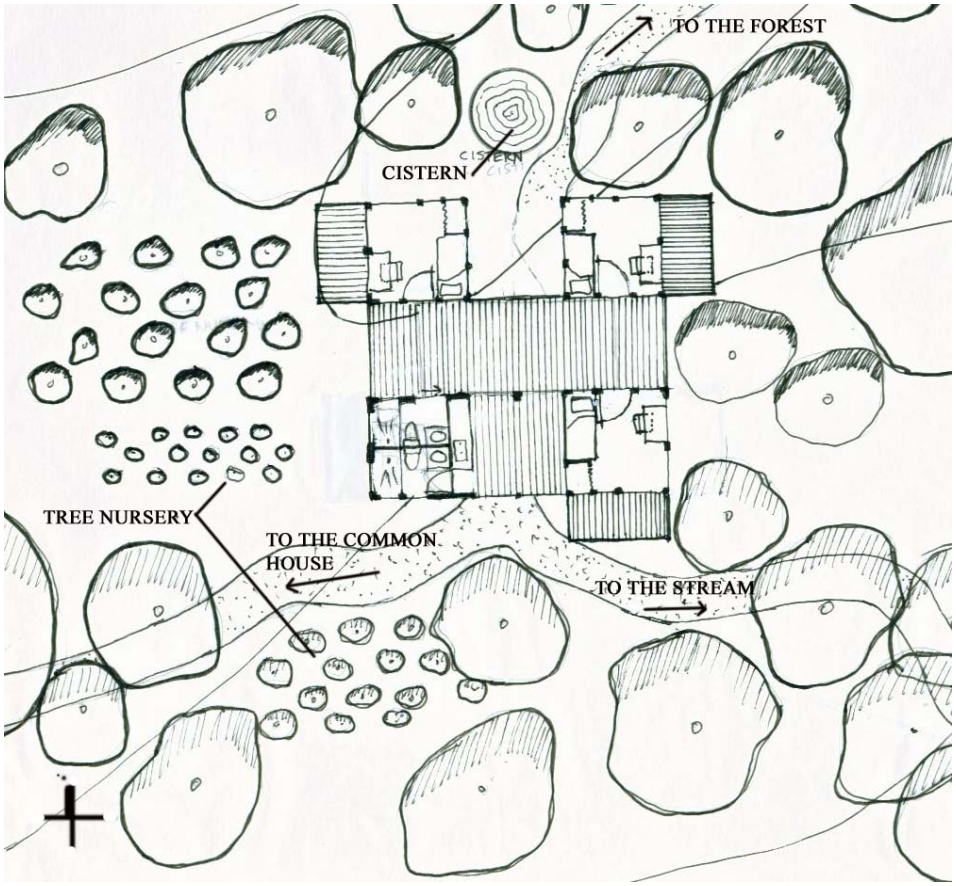

Figure 42. "Eyes on the Forest" units sited amongst the trees and tree nursery

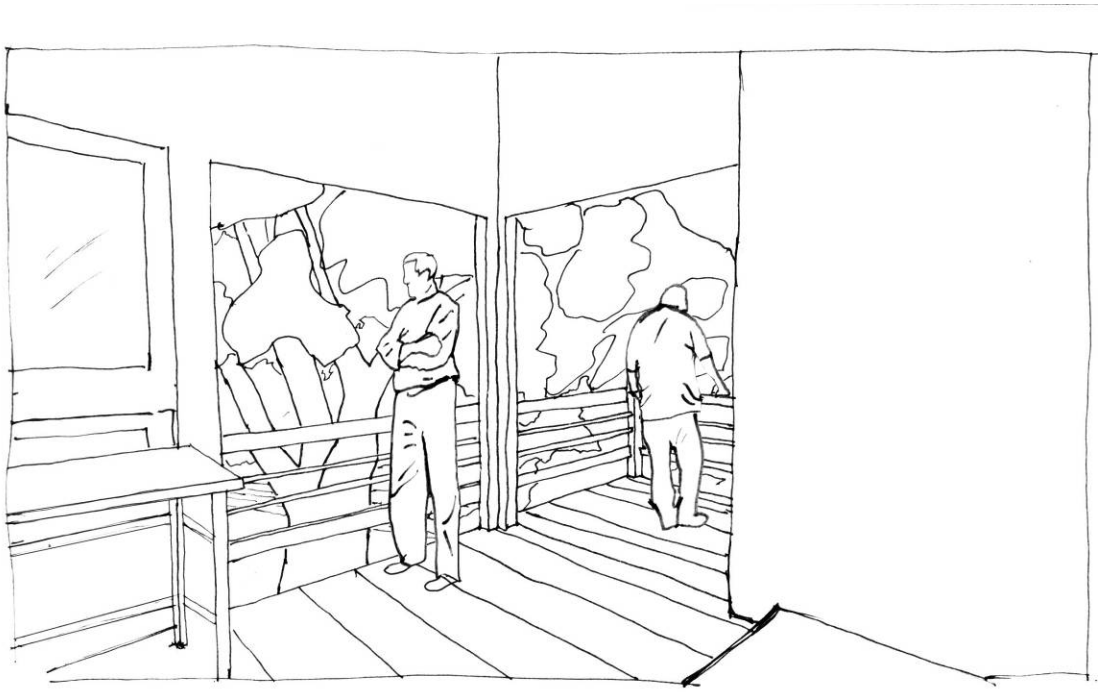

Figure 43. Experiencing the trees from new levels in the "Eyes on the Forest" units

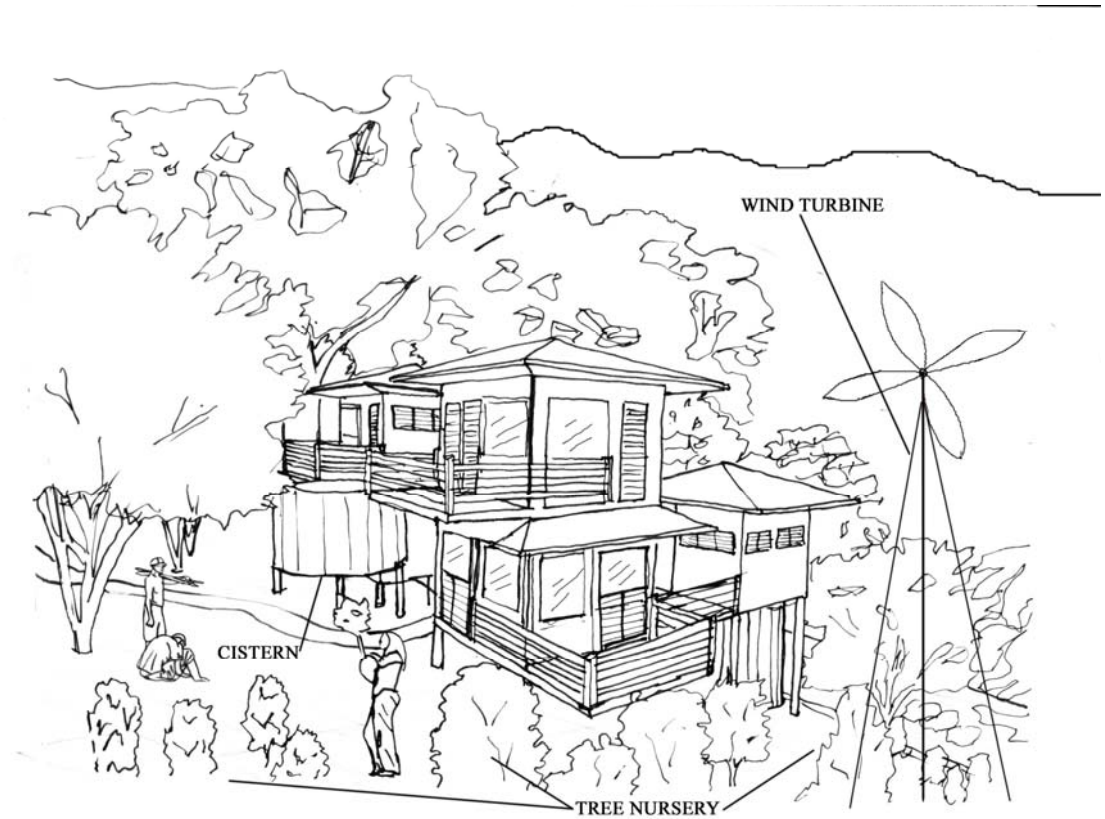

Figure 44. Planting native trees at the "Eyes on the Forest" units

Figure 45. Learning about the native flora and fauna at the "Eyes on the Forest" units.

"Eyes on the Wetland"

The "Eyes on the Wetland" units are located above the ponds and stream where they will have the opportunity to observe this unique ecosystem throughout the year (see figs. 29 and 46). The units are designed to keep a low, unobtrusive profile that mimics the ponds below (see fig. 49). The foundation will be concrete posts placed on the 11 ft grid, causing as little disturbance to the earth below as possible. Observation decks are found outside each sleeping unit, again encouraging a closer connection to the natural environment, especially the wetland on which many of their projects will focus. Views of the wetland are provided from each of the rooms as well(see fig. 47).

These units will be located in proximity and with a view of the "Living Machine". This water filtration system will be used to process the black and grey water from the Paradise Park Structure, the Common House and various housing groups. Not only will this system reduce the impacts on the city sewer system, it will also be a beautiful addition to the natural wetland landscape and act as a demonstration project for the community. Parts of this constructed wetland will act as the fish hatchery for the small fry that will be transferred to the larger ponds below when old enough.

Wetlands represent nature's water filter. The restoration of the wetlands at the back of the valley has the potential to clean the water of various chemical and biological pollutants before heading downstream to the ocean. Although much of the water pollution in Mānoa comes from the homes that are downstream from the ecovillage, the ecovillage could still be a place to learn about water and pollution, teaching the residents of the valley how they can help protect the water and reef through their own personal habits.

Wetlands offer habitat for birds, fish and various other plants and animals. Creating this habitat helps to increase biodiversity. The wetlands also offer the potential to restore the ancient Hawaiian tradition of aquaculture as well as terraced gardening. The food provided by the fish ponds and the gardens will also offer sustenance for the humans living on the site. The wetlands also provide places for recreational activities such as fishing, walking, birding, and quiet reflection (see fig. 48).

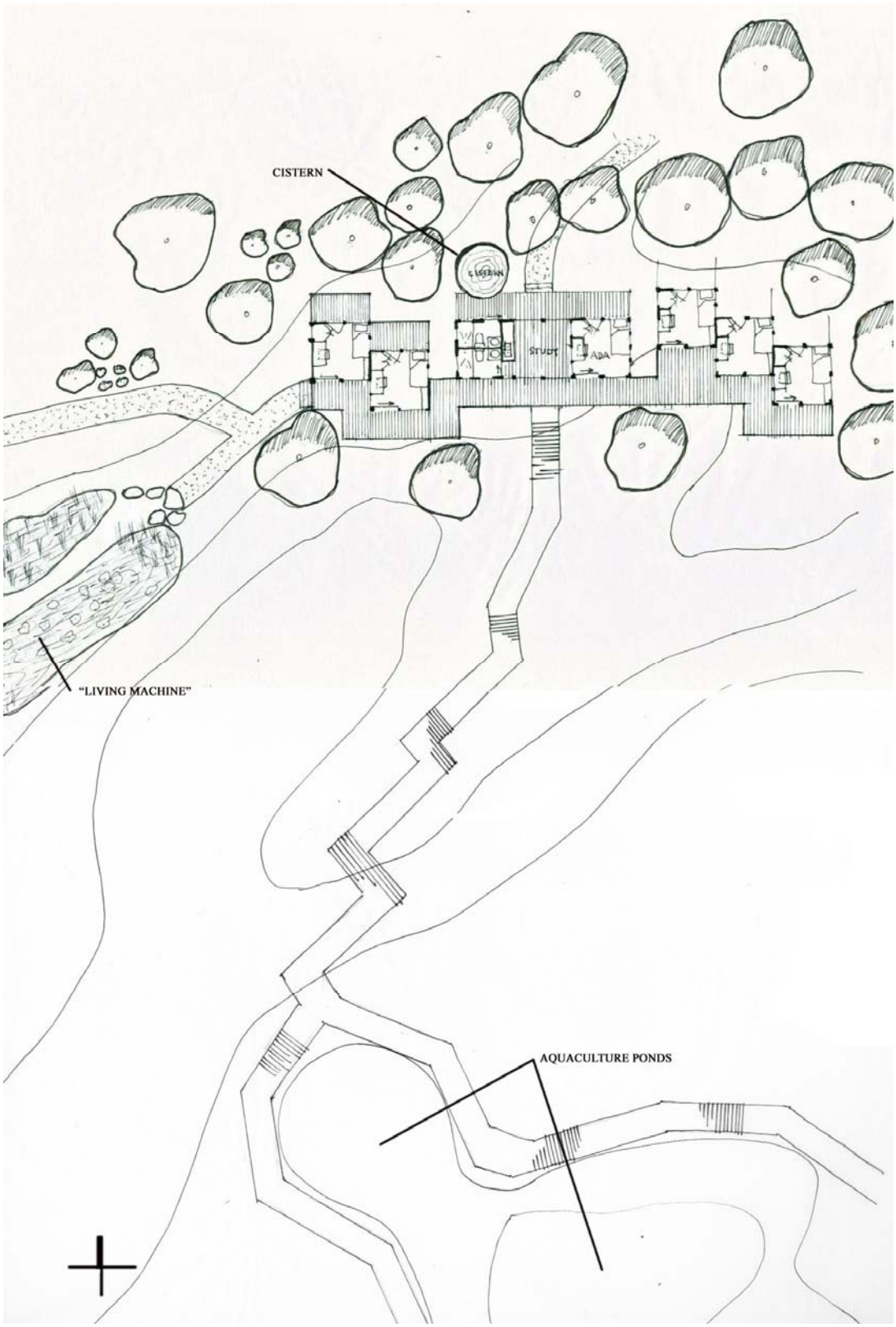

Figure 46. "Eyes on the Wetland" units sited above the ponds and adjacent to the "Living Machine"

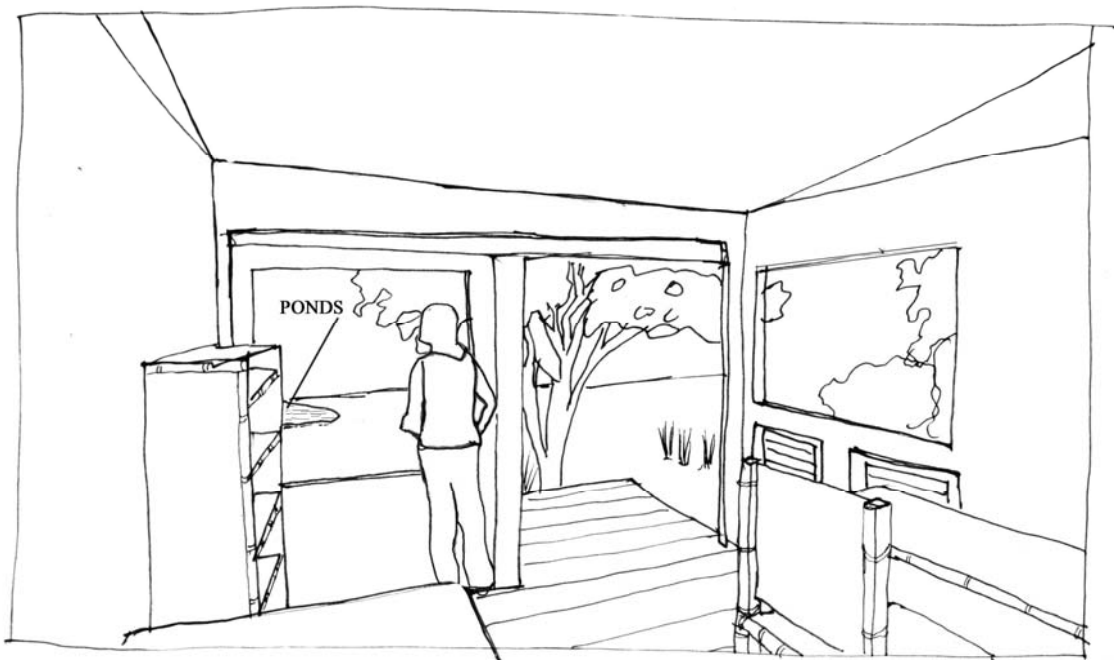

Figure 47. Watching the ducks and geese gather in the ponds below from the "Eyes on the Wetland" units

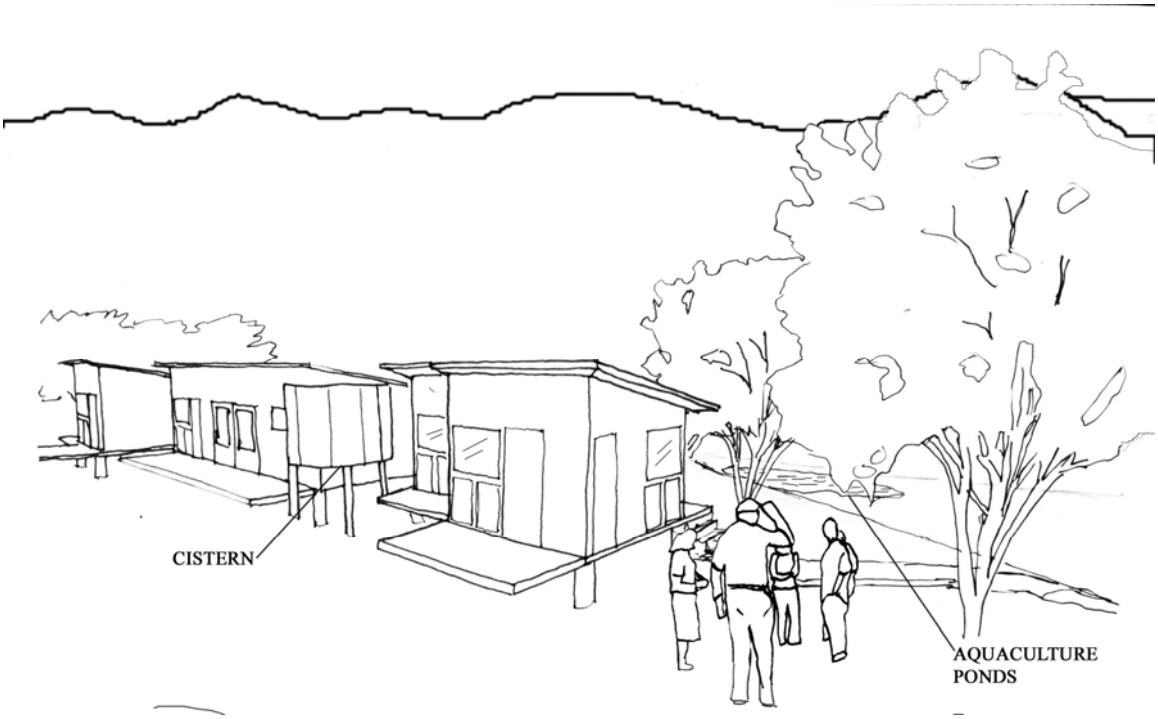

Figure 48. Taking a tour at the "Eyes on the Wetland" units

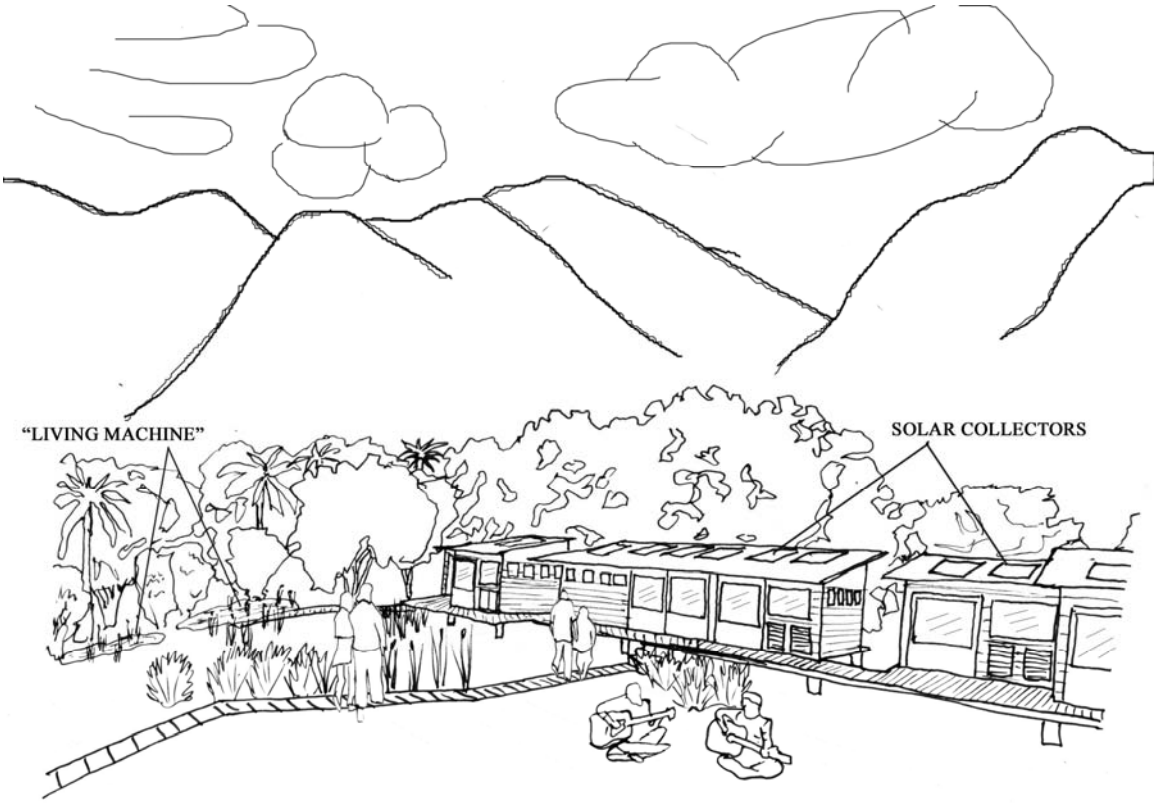

Figure 49. Relaxing and celebrating a sunny day at the "Eyes on the Wetland" units

History of Agriculture in Mānoa

The history of a site and how the land was traditionally used can lead to more informed design decisions. There is the potential to save time and energy by learning from other's success and failures in their attempts to live upon the land. This history offers both warnings and clues to how the land tends to behave over the span of geological time.

Although the fresh waters of Mānoa made it an ideal place to grow food, this leeward side of the island was initially appreciated more for its fishing, forests and birds.[109] As the valley became inhabited, trails were formed by human feet from the mountains to the sea. The back of the valley could offer supplies from the forest such as building materials. For those closer to the sea, the valley became a shimmering pool of

[109] Cordy, *The Rise and Fall of the O`ahu Kingdom,* 8.

lo`i filled with taro that was also exchanged with others up and down the trail. Sweet potato, banana, coconut, and sugarcane were being cultivated as well on the drier lands. Seafood and other supplies were provided by the ocean off the shore of Waikīkī. This shared use of land was known as the *ahupua`a* system and was partially determined by the geographic features of the valley.

The missionaries that arrived in Hawai`i in the early 19th century helped to educate the Hawaiian people in the ways of the western world, and in return, the chiefs granted them large parcels of land to help them support their missions. Chief Boki, the first governor of Hawai`i, granted land in Mānoa Valley to the mission of Hiram Bingham in 1829 at the site of one of the most revered fresh water springs in the valley, *Ka Punahou*. These land grants were often given by the king much to the dismay of the Hawaiian commoners and *konohiki*, or landlords.[110] Oftentimes land was taken away from the Hawaiian people who were using it to sustain an existence. The king felt that a western education was more important to the people than living the old ways of cultivation and crafting. As agriculture became more and more of a commodity in Hawai`i, the valley of Mānoa began to be cultivated in all variety of experimental commercial crops, such as coffee, sugar and pineapple. Cattle and horses began to make their mark on the valley, while taro fields still covered the low lands.

After the Great Māhele of 1848, the sugar planters in Hawai`i finally felt secure enough in their land holdings to start making improvements to the lands, such as more irrigation ditches. Due to the lack of a Hawaiian labor force, or lack of willingness of the Hawaiians to participate, the plantation owners began to import labor from China.[111] The first contract labor from China arrived in Hawai`i in 1852. The valley of Mānoa was known during this time to still be almost completely cultivated in taro, by the Chinese, not Hawaiians. Items such as rice, sugar, pineapple and coffee were all being experimented with as potential cash crops. In a history of Mānoa Valley, David DeLeon quotes Thomas Thrum who wrote annual reports on the islands, "It is a matter of deep regret that the evidences of decline are so apparent, not only of people, but in the

[110] Kamakau, *Ruling Chiefs of Hawai`i*, 355 .
[111] Tin-Yuke Char, *The Sandalwood Mountains: Readings and Stories of the Early Chinese in Hawai`i* ( Honolulu, HI: University Press of Hawai`i, 1975), 59.

condition of their dwellings. The former residents of the valley have passed away, and few of the present inhabitants are living on the land of their fathers, or continuing their industries. These are now wholly in the hands of the Chinese…" [112] The Chinese during this time were producing 80% of the poi, the Hawaiian staple food made from taro, and they were credited for "keeping Honolulu from the scarcity of table vegetables."[113]

The agricultural lands of Mānoa were once again in the hands of people whose spiritual beliefs, in general, reflected a love of nature and an appreciation for the magic and mystery of the natural world. Their objects of worship were "the forces of nature, ancestors, ancient heroes, and patron deities." [114] It was common practice for one person to practice all three of these belief systems.

The Chinese that had taken care of the agricultural land of Mānoa were eventually replaced by a wave of Japanese immigrants that were coming to the islands to work in the sugar industry. In *Mānoa, History of a Valley* it is mentioned that a group 89 Japanese farmers formed an intentional community near the back of the valley, offering "mutual support and social interaction."[115] The Iwasaki family was said to have farmed the back of the valley on the land currently known as Paradise Park.[116] This first generation of Japanese brought with them their culture and spirituality from home in Japan.[117] This would mean beliefs in Buddhism, Taoism, and Shinto. Similar to the Chinese who had come before. The Japanese were growing mass amounts of flowers and vegetables for their own consumption and to be sold in the markets in town and on the mainland. They were also growing bananas and running dairy farms in the valley as well.

By the 20th century the land in Mānoa was being developed for residential purposes. The creation of the Ala Wai and the drilling into the water table finally drained and diverted the water of Mānoa. The story of agriculture and water gardens Mānoa Valley was now becoming more a legend of a time far gone, so far gone that one finds it hard to believe that the valley once reflected the sky through multiple mirrored ponds.

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[112] David DeLeon, 1978. *A Short History of Manoa Valley from 1800 to Present* (Report, University of Hawai`i), 5.
[113] Manoa Valley Residents, *Manoa,* 19.
[114] Ibid., 183.
[115] Manoa Valley Residents, *Manoa*, 23.
[116] Manoa Valley Residents, *Manoa,* 23.
[117] Coulter, "Manoa Valley, Honolulu," 127.

"Eyes on the Garden"

The "Eyes on the Garden" units are designed to take into account the traditional Hawaiian polyculture through the use of intensive terracing (see figs. 29 and 50). Creating these terraces for gardens naturally allows for the creation of housing within these same contours. Since the earth will undergo grading and contouring and because there is the desire for grounding the building, the foundations will be a combination of slab on grade and piers. The "Eyes on the Garden" units are located near the children's vegetable garden at Lyon Arboretum, below the cottages. This location had been graded previously, offering nice flat areas on the hillside for foundations, but is still on a sloping hillside that allows for terracing.

This terracing, which will take advantage of stone salvaged from the Winne Units, allows all of the various spaces to have a connection with the ground (see fig. 51). This grounding effect is intended to help nurture a closer connection between the humans and the land, while at the same time making the residents more aware of the condition of the plants in order to offer them the intimate care they need to be fruitful.

These units are taking advantage of the vertical growing space in other ways as well. Trellises will be used vertically and horizontally to grow vining vegetables and plants while at the same time acting as shade devices and wind breaks as well. The vines and plants will be allowed to grow across the rooftop to aid in water retention and with absorption of solar energy. This will help to keep the building cooler and help to reduce runoff of rainwater from the roof. The rainwater harvested from the rooftops will be used to irrigate the garden terraces that are an integral part of the structure of the units as well as for showers and sinks (see fig. 52).

These units, located amongst the terraces of the garden, have many ecological, cultural and spiritual benefits. Food that is grown locally and organically reduces the need for fossil fuels used in the fertilizing and distribution of the produce. Food grown in close proximity to the final consumer can be allowed to ripen fully and can be eaten directly after harvesting, improving the nutritional value. These terraced gardens also restore the tradition of Hawaiian terraced garden polyculture, which is a far more appropriate form of agriculture for tropical regions. The participants will be encouraged to spend many intimate hours with each other on the land that feeds them, allowing for a

greater appreciation of the land, and how it provides, to develop in their hearts and minds (see fig. 53).

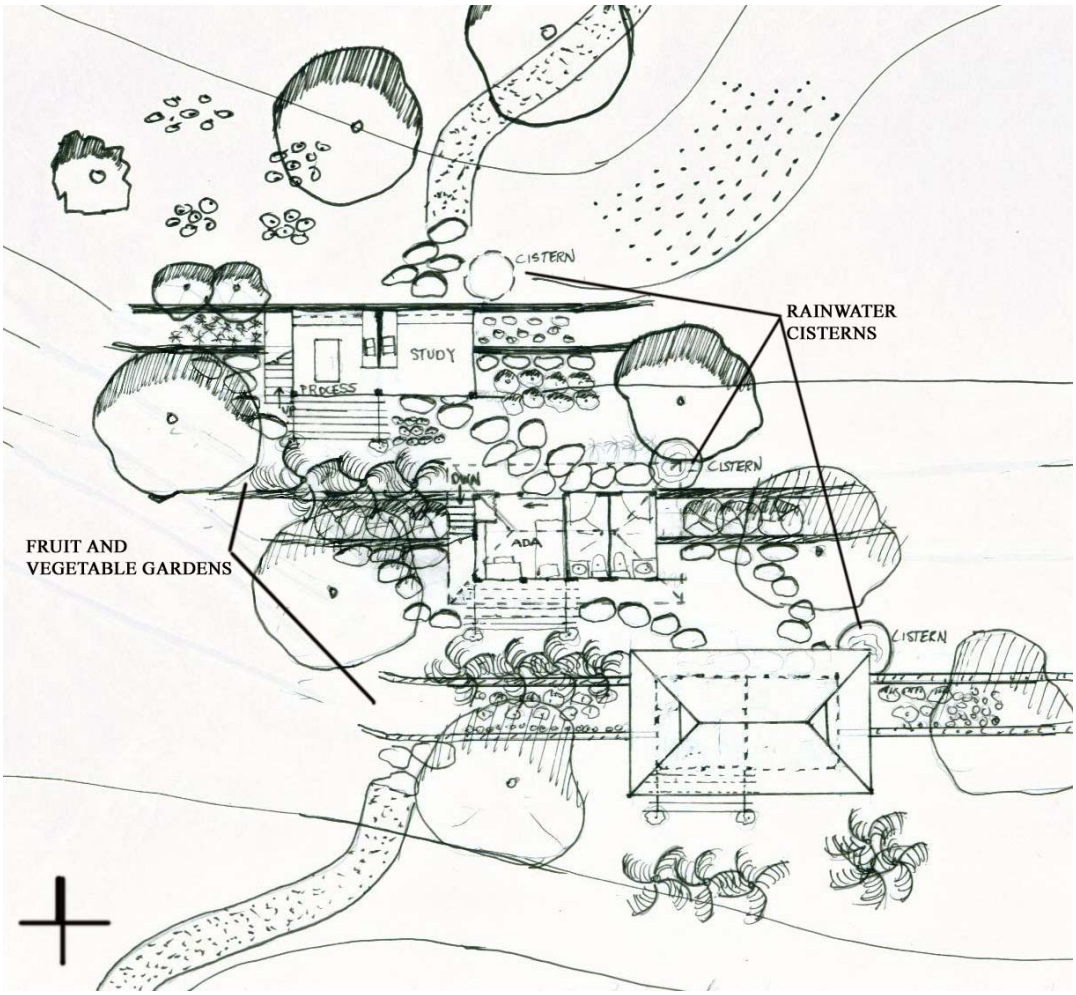


Figure 50. "Eyes on the Garden" units sited in the midst of a terraced hillside garden.

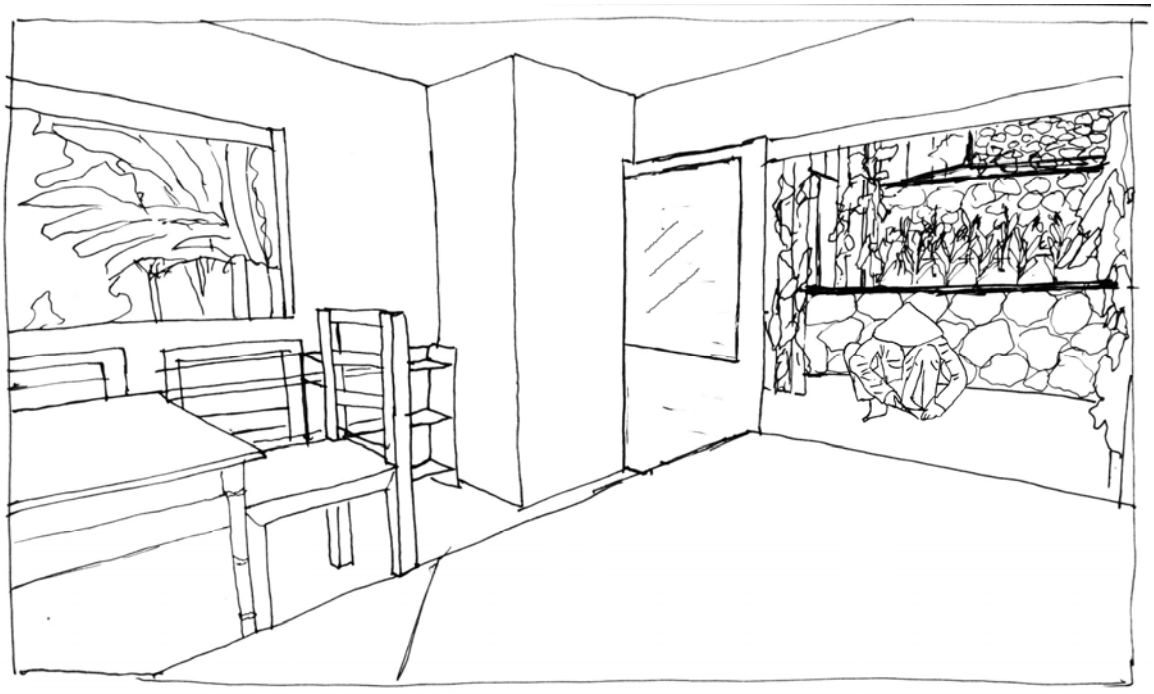


Figure 51. Pulling the weeds outside the bedroom at the "Eyes on the Garden" units

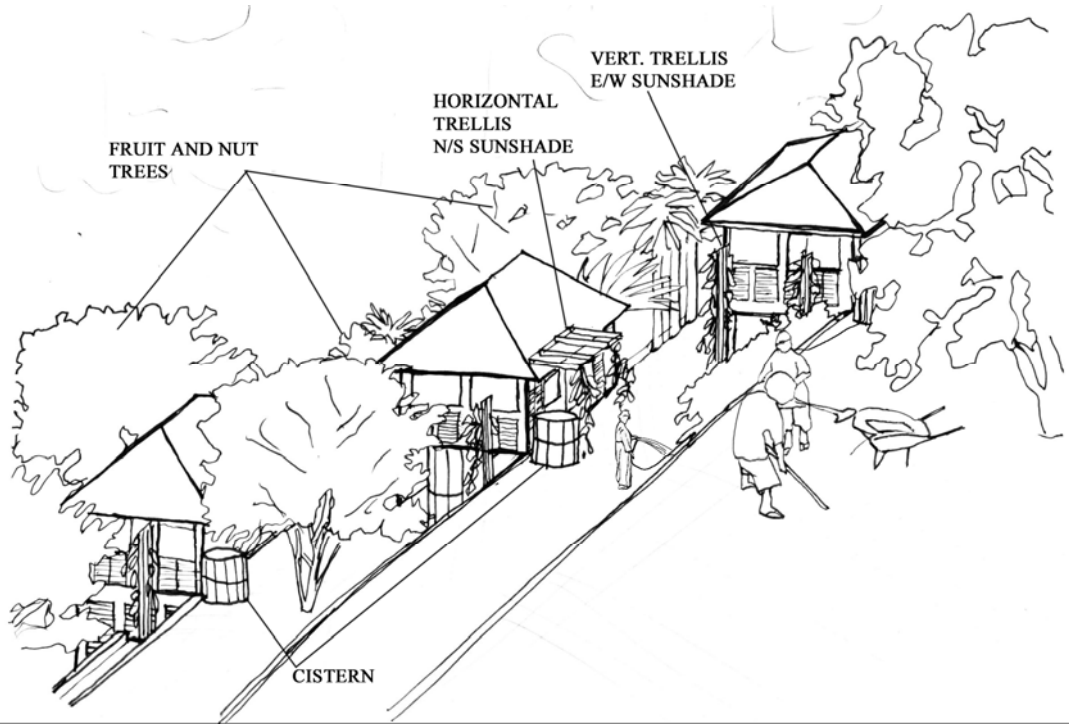


Figure 52. **P**lanting vegetables and watering with harvested rainwater at the "Eyes on the Garden" units

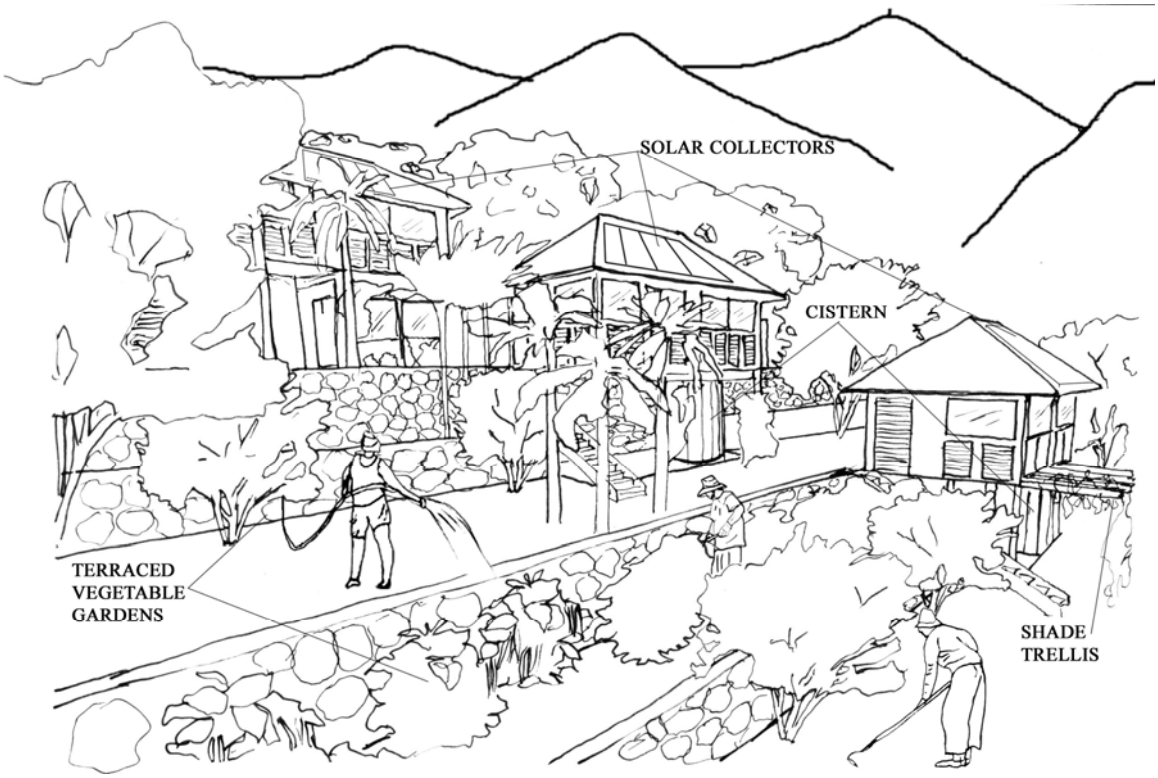


Figure 53. Spending quality time with friends and the *`aina* at the "Eyes on the Garden" units

Chapter 15: Conclusion

Ecovillage Mānoa offers many opportunities for the learning and teaching of an ecological consciousness through its natural ecology, built environment, and unique educational program. Because ecological consciousness must take place at the spiritual, cultural and physical levels, all were explored throughout the design process.

The site selection was based on various physical and ecological factors, such as proximity and symbiosis with the university. Culturally, the site selection was based on the greatest benefit to the community as far as educational opportunities and benefits of student projects to the valley. Keeping it close to the university means building social capital needed to protect the environment. The history of the place and its people also gave clues to the appropriateness of the ecovillage to Mānoa Valley, which includes the history of tight knit communities who took care of the land. Spiritually the site offers a sense of power and mystery of the natural world, as well as potential for humans to explore their connection to the natural environment through participation in its healing and protection.

In-depth site and cultural analysis was used in determining the best way to integrate humans into the site. Physically the site already offered many structures that could be reused, as well as roads and parking that could be put to use without having to disturb the fragile ecosystem. The site was divided into conservation, preservation and restoration areas in order to protect the natural environment as deemed appropriate for the location and soil types. The choice of land divisions and uses was based on historical review of the traditional Hawaiian culture that had developed out of this land. For instance, the choice to include agriculture, especially fish ponds and terraced polyculture, was based on the traditional culture and the sustainability aspects of locally grown food.

The various housing groups are spread throughout the village in order to keep an eye on the land to better protect it. These various units offer unique learning experiences for the residents through different types of connections with the land. Not only are the residents able to observe the land, they are able to develop more intimate relationships with the land, thus returning it to their ethic.

The buildings have been designed using a grid for easy construction and to better provide for the use of the salvaged materials from the Winne Units. Other resources from the valley, such as bamboo and Albizia have been included in the design. Other factors that are reducing the footprint of these structures are the use of rainwater harvesting and on-site waste water treatment, as well as on site renewable energy production. The Common House and the Mānoa Center both act as centers for people to gather in order for a culture of sustainability to develop. It is in these spaces, as well as in the houses and on the land, that ideas, stories, songs, and shared meals will help to define this culture based on sustainability and education.

Ecological consciousness is a thought, it is a culture and it is a place. It is a place that acknowledges history, tradition, and genius loci. It is a place where we are reminded and made aware of that which sustains us. It is conservation, restoration, and preservation of that which feeds us. It is a place of lifelong and holistic learning, a place to share, store, and research local knowledge, a place for conversation and celebration of life. It is an Ecovillage.

Appendix A Electricity Demands

Energy Demand (numbers are reduced due to passive solar design strategies and energy efficient options in electronics.

Typical Wattages of Various Appliances[118]

- Aquarium = 50–1210 Watts
- Clock radio = 10
- Coffee maker = 900–1200
- Clothes washer = 350–500
- Clothes dryer = 1800–5000
- Dishwasher = 1200–2400 (using the drying feature greatly increases energy consumption)
- Dehumidifier = 785
- Electric blanket- *Single/Double* = 60 / 100
- Fans
  - Ceiling = 65–175
  - Window = 55–250
  - Furnace = 750
  - Whole house = 240–750
- Hair dryer = 1200–1875
- Heater *(portable)* = 750–1500
- Clothes iron = 1000–1800
- Microwave oven = 750–1100
- Personal computer
  - CPU - awake / asleep = 120 / 30 or less
  - Monitor - awake / asleep = 150 / 30 or less
  - Laptop = 50
- Radio *(stereo)* = 70–400
- Refrigerator *(frost-free, 16 cubic feet)* = 725
- Televisions (color)
  - 19" = 65–110
  - 27" = 113
  - 36" = 133
  - 53"-61" Projection = 170
  - Flat screen = 120
- Toaster = 800–1400
- Toaster oven = 1225
- VCR/DVD = 17–21 / 20–25
- Vacuum cleaner = 1000–1440
- Water heater *(40 gallon)* = 4500–5500
- Water pump *(deep well)* = 250–1100

[118] US Department of Energy: Energy Efficiency and Renewable Energy, "Estimating Appliance and Home Electronic Energy Use," US Department of Energy, http://www.energysavers.gov/your_home/appliances/index.cfm/mytopic=10040 (accessed April 29, 2009)

Student/faculty electricity demands (per housing group)

	Total #	hours/day	watts	watt-hours	
Laptop computer	6	8	50	2400	
lamp	10	6	14	840	
mini-refrigerator	1	8	150	1200	
27" TV	1	6	113	678	
ceiling fans	7	10	65	4550	
stereo	4	4	100	1600	
hotplate/microwave	1	2	750	1500	
clock radio	6	24	10	1440	
water pump	1	7	250	1750	
Hot water SOLAR					
					watt-
			TOTAL:	**15958**	hours/day
				15.958	kW/day

Common House electricity demands

	Total #	hours/day	watts	watt-hours	
Laptop computer	2	8	50	800	
lamp	4	6	14	336	
refrigerator GAS					
27" TV	1	6	113	678	
ceiling fans	3	10	65	1950	
stereo	1	4	100	400	
Stove/oven GAS					
water pump	1	7	250	1750	
coffee maker	1	2	900	1800	
washing machine	2	2	350	1400	
dishwasher	1	1	1200	1200	
aquarium	1	24	50	1200	
hot water SOLAR/GAS					
					watt-
			TOTAL:	**11514**	hours/day
				11.514	kW/day

Appendix B Sizing the Photovoltaic System

Orientation

Roof areas provided for photovoltaic arrays are facing due south and are angled within 15 degrees of the latitude; which is 21 degrees.

Sizing Photovoltaic Array (based on 10 w/sf crystalline collectors)

1. **Student/faculty housing** (demand based on Appendix A)

   15.9 kWh per day = 4.0 sun hours per day x (10 w/sf x sf of panel) / 1000 w/kW

   Size = 397.5 sf of panel req. to supply 100% of electricity demand for one housing group

2. Common House (demand based on Appendix A)

   11.5 kWh per day = 4.0 sun hours per day x (10 w/sf x sf of panel) / 1000 w/kW

   Size = 287.5 sf of panel req. to supply 100% of electricity demand for the common house

Appendix C Sizing the Wind Turbines

Wind Turbine Supply (Structures are also located in areas with average wind speeds of over 13 mph)

1. Based on NREL guidelines for Hawai`i:

1.5 kW turbine, average wind speed of 14 mph = 10 kWh per day[119]

One 1.5 kW wind turbine would supply 60% of electricity demand for one housing group

One 1.5 kW wind turbine would supply 90% of electricity demand for the common house

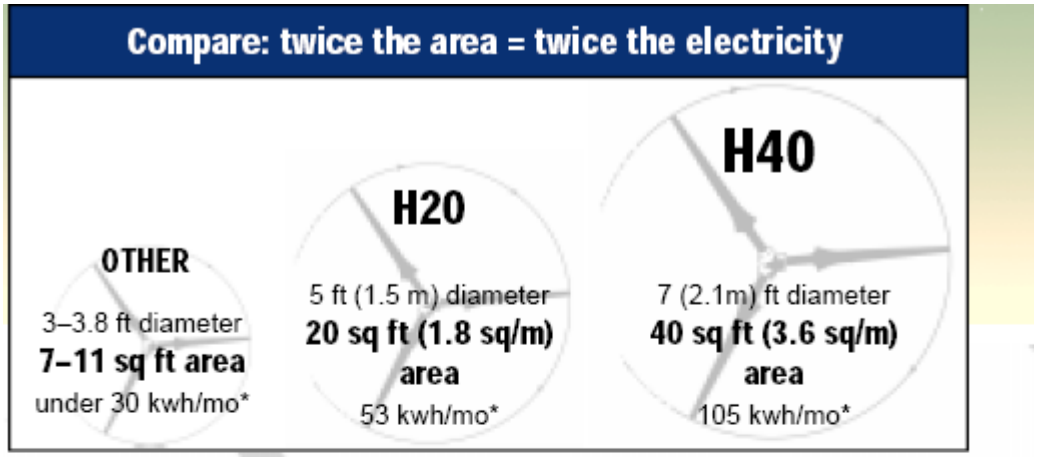
2. Based on manufacturer's product information listed in Figure 61:

The total residential electricity demand for the ecovillage:

(7 housing units x 15.9 kWh/day) + 11.5 kWh for the common house= 122.8 kWh/day

One H4O 7ft diameter wind turbine with and average of 12mph winds would supply 105 kWh/month, or 85% of the entire ecovillage electricity demand.

[119] NREL, *Small Wind Electric Systems, A Hawaii Consumer's Guide 4* (DOE National Laboratory, March 2005), 4.



SPECIFICATIONS

Peak power@12.5m/s(28 mph)	500 watts
Rated power@10m/s(22mph)	230 watts
Cut-in wind m/s / mph	3.4/7.5
Controller included	EZ 90/900
Molded, fiber reinforced blades	3
Prop tip to center cm/in	29/11
Min. blade clearance cm/in	15/6
Standard battery voltage	12
Battery voltages selectable	24,32,48
Standard mount pipe	2.5"schd40
Lateral thrust nts/lbs	210/50
Tower top weight kg/lbs	16/35
Ship dim cm/in	79x41x28/31x16x11
Ship wt kg/lbs	25/55

Average Wind Speed		Kilowatt Hours
mph	m/s	kwh/month
8	3.6	15
9	4.0	23
10	4.5	31
11	4.9	41
12	5.4	53
13	5.8	65
14	6.3	78

Figure 54. Wind Turbine Specifications
Source: World Powers Technologies, Inc., *Whisper H20: Size Matters* (Duluth, MN: World Powers Technologies, Inc.)

Appendix D Sizing the Rainwater Harvesting System

Water Catchment (average rainfall of 120 in/year)

Demand for boarding house type dwelling unit = 50 gal/day/person plus 10 gal per day for nonresidential boarders. These demands should be reduced by 25% for water conservation[120]:

40 residents x 50 gal/day x .75= 1500 gal/day x 30 days/month = 45,000 gal/mth
30 visitors x 10 gal/day x .75 = 225 gal/day x 30 days/month= 6750 gal/mth
Total= **51,750 gal/mth**
or **621,000gal/year**

Supply:

Supply for entire year = estimated 19, 700 sf of catchment area for ecovillage x .625 gal/in/sf of catchment area x 122 in/rain avg. x 2/3 for dry year

= 1,001,416 gal/year of rainwater potentially harvested from rooftops

1,001,416 gal/year supply – 621,000 gal/year demand= **380,416 gal** surplus for the year

Supply for wettest month of January = estimated 19,700 sf of catchment area for ecovillage x .625 gal/in/sf of catchment area x 14 in/rain avg. x 2/3 for dry year

= 114, 916 gal of rainwater potentially harvested from rooftops

114,916 gal- 51,750 gal demand= **63,116 gal** surplus in January

Supply for driest 4 months of year= estimated 19, 700 sf of catchment area for ecovillage x .625 gal/in/sf of catchment area x 22.74 in/rain avg. x 2/3 for dry year

= **186,657** gal of rainwater potentially harvested from rooftops in driest 4 months

186,657 gal supply – (51,750 gal/mth demand x 4) = **(20,343) gal** deficit in driest 4 months

[120] Stein, Benjamin and John S. Reynolds, *Mechanical and Electrical Equipment for Buildings.* Ninth Edition (New York: John Wiley & Sons, Inc., 2000), 538-539.

Cistern Sizing

51,750 gal/mth demand + 20,343 gal deficit for driest months= **72,093 gal** cistern required for storage. Assuming that 80% of the water usage will take place at the common house and the other 20% in the housing units.

Common House
72,093 gal x .80 for common house = 57,674 gal of cistern storage for common house
= **2 cisterns 15 ft deep and 18 ft in diameter**

Student/faculty housing
72,093 gal – 57,674= 14,419 gal of cistern storage for housing units

14,419/ 7= 2060 gal of cistern storage per housing unit
= 1 cistern 7 ft deep and 7 ft diameter per housing unit

Appendix E Sizing the Solar Domestic Hot Water

Solar Domestic Hot Water

Demand

"Contractors usually follow a guideline of around 20 square feet (2 square meters) of collector area for each of the first two family members. For every additional person, add 8 square feet (0.7 square meters) if you live in the U.S. Sun Belt area or 12–14 square feet if you live in the northern United States.

For active systems, the size of the solar storage tank increases with the size of the collector—typically 1.5 gallons per square foot of collector. This helps prevent the system from overheating when the demand for hot water is low. In very warm, sunny climates, some experts suggest that the ratio should be increased to as much as 2 gallons of storage to 1 square foot of collector area."[121]

Collector Size:
40 residents = approx 7 families with 6 members

(2 family members x 20 sf of collector)+(4 family members x 8 sf)= 72 sf of collector

72 sf of collector per family x 7 families = 504 sf of collector required for entire ecovillage hot water supply

Storage Capacity:

504 sf of collector area x 2 gal per sf of collector area = 1008 gal of storage required

[121] US Department of Energy: Energy Efficiency and Renewable Energy, "Sizing a Solar Water Heating System," US Department of Energy, http://www.energysavers.gov/your_home/water_heating/index.cfm/mytopic=12880 (accessed April 29, 2009)

Appendix F Sizing the "Living Machine"

Wastewater Treatment with "Living Machine"

2000 gal/day of wastewater requires 1100 sf for the Living Machine Hybrid Wetland (see fig. 62)

2000 gal/day of wastewater requires 300 sf for the Living Machine Tidal Flow Wetland (see fig. 62)

SYSTEMS PROFILE COMPARISON

	Living Machine Tidal Flow Wetland	**Living Machine Hybrid Wetland**	Horizontal Subsurface Flow Wetland	Vertical Subsurface Flow Wetland	Advanced Activated Sludge System
Footprint* (ft^2)	**150**	**550**	1,250	330	75
Energy Use**	**0.5**	**0.4**	0.1	1.0	2.0
Effluent Quality	**Tertiary + Reuse*** **	**Tertiary + Reuse*** **	Secondary	Tertiary + Reuse***	Tertiary
Operating Costs	**Low**	**Low**	Low	Low	High

* Sq-Ft/1000 gal/day; estimate for 30,000 gallon per day systems
** Kwh/1000 gal/day; estimate for 30,000 gallon per day systems
*** Typical non-potable reuse includes subsurface irrigation, toilet flushing, effluent discharge to rivers and lakes and/or wash water

Figure 55. Living Machine system comparisons and sizing requirements
Source: Worrell Water Technologies, *Living Machine: Water for Our Future Worldwide,* Worrell Water Technologies, LLC., 2007.

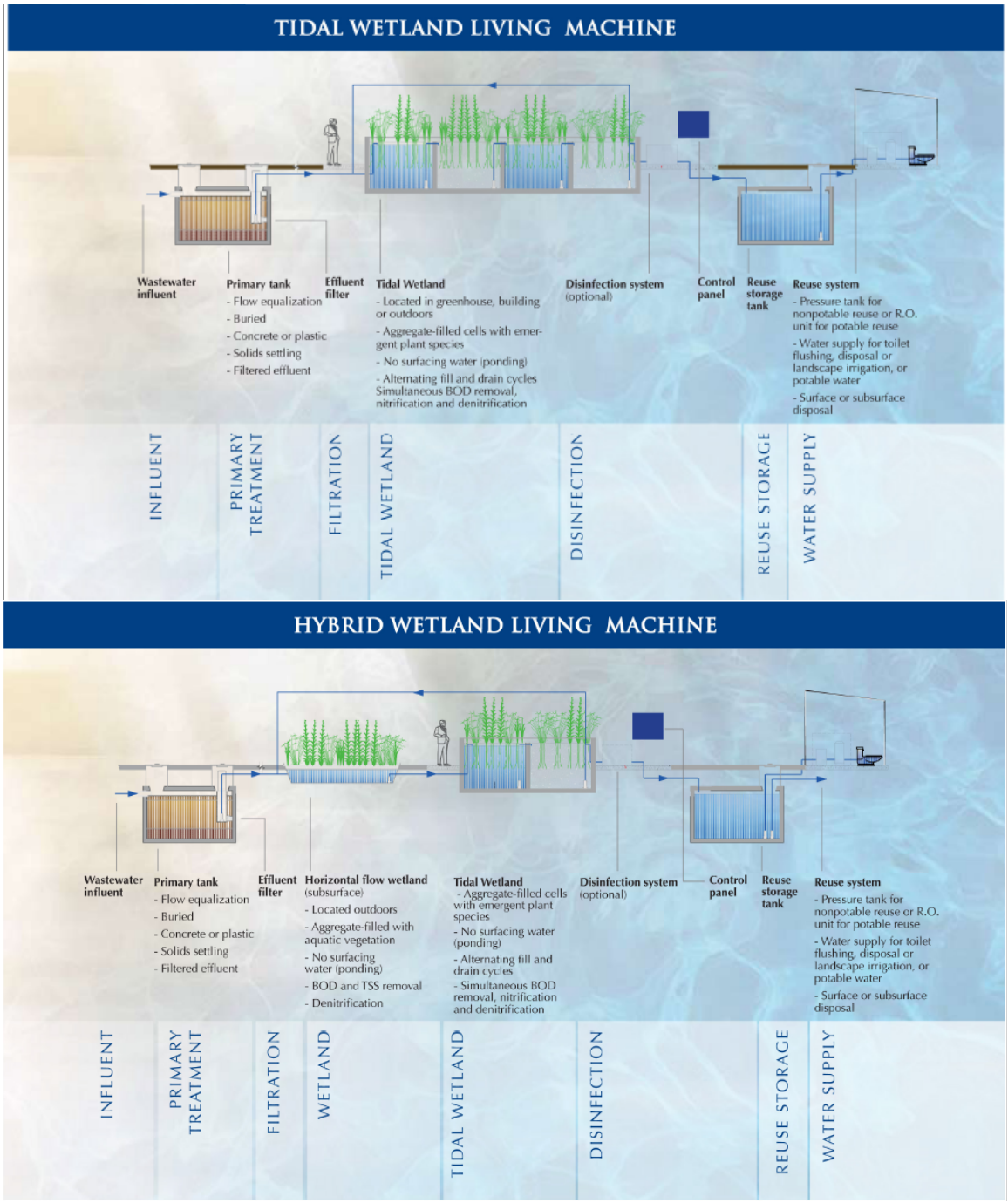


Figure 56. Living Machine by Worrell Water Technologiesurce: Worrell Water Technologies. Living Machine: Water for Our Future Worldwide. (Worrell Water Technologies, LLC.,2007)

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